THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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	Page
Industrial Problems	265
Power House Operation and Maintenance	266
Electricity and Steel Testing	267
Notes on the Action of Automatic Protective Gear on a Large A.C. Network, by C. W. Marshall (*illus.*)	268
The Electrical Industry in Russia, by A. Monkhouse	269
New Electrical Devices, Fittings and Plant (*illus.*)	271
A Portable Automatic Coal-Trimming Conveyor (*illus.*)	272
The British Scientific Products Exhibition (*concluded*) (*illus.*)	273
War Items	275
Legal	275
Correspondence—	
Wanted: A Book	276
Business Notes	276
Notes	279
City Notes	283
Stocks and Shares	284
The Duties of the Progress Department, by W. J. Hiscox (*continued*)	285
The Electrical Properties of Vulcanised Fibre, by W. Eves (*illus.*)	285
New Electric Furnaces (*illus.*) (*concluded*)	286
New Patents Applied for, 1918	288
Abstracts of Published Specifications	288
Contractors' Column	Advertisement page xxvi

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INDUSTRIAL PROBLEMS.

SIMULTANEOUSLY with the move forward of the vast military organisation of the Allies with better prospects of more speedily crushing out of the Enemy terms of Peace which will ensure security for the future, there is again heard in many directions at Home the grating of the machinery of Labour organisation. The Premier is able to assure us that "the Worst is Over" in a Military Sense, but our satisfaction with that assurance is modified somewhat by new demands from workers in many departments of activity which indicate that the same phrase cannot be applied to the Home Front. The most deplorable feature of the industrial unrest which is present amongst us just now is that it is not by any means all or most of it the immediate consequence of the hardships of war conditions.

Among the latest demands or strike threats there have been the following:—A demand for non-employment of non-Union labour; attempts to compel men of certain classes to join particular unions; a demand for women to have the same rate of war bonus as men; a demand for war bonus payments to be converted into a slightly reduced permanent advance in the normal wage; a demand for the recognition of a Union, increased leave, and eight-hour shifts "after the war"; increase in overtime rates because wage increases have produced the anomalous state of things that makes overtime rates less than ordinary wage rates. These are a few of the points that occur to us as suggesting that the workers in at least some departments of labour are intent on securing, while the war is still in progress, improved or altered conditions for after the war. Probably there lies at the root of it all the widespread uncertainty concerning what is going to happen in regard to the cost of living after the war. Everybody, we suppose, welcomes the improved prospects of Peace, but none knows what that Peace will bring to millions of workers; therefore, the policy favoured at the moment seems to be: Get what you can while you can! And, unfortunately, the "strike" habit seems to be stronger than at any previous period of our history.

The determination on the part of employés of State and municipal undertakings to secure future benefit *now* is supported by the knowledge that their earnings are not regulated by industrial profits. The State Exchequer and the ratepayers will have to pay. But what of industrial workers who cannot draw more than industry will yield? We may fix the prices of war requirements according to the demands of labour and the exceptional prices of material, because we are spending out of Capital to win the war. The time is coming when that state of things cannot continue. We observe that Mr. G. N. Barnes, M.P., has been asking what we are going to do in the post-war period to safeguard and maintain the high standard of living that has come to most of the working people during the war. Personally, he believes the Whitley Report to represent a great idea which is capable of great expansion; but the A.S.E., the Union for which he fought long years ago, certainly does not see eye to eye with him in this. According to its spokesmen that Union, which he did so much to build up, feels strong enough to go alone. It can make its claims and back them up, and needs none of the Whitley conciliation spirit. What the A.S.E. is out for ultimately is control. It makes no secret of that ambition. What has Mr. Barnes to say on this point? We observe that he expresses the hope that the national factories put down during the war will not be allowed to be transferred to private owners: he wants them to be retained as national factories, and by that means to lessen the National Debt. He cannot, we suppose, say what they will produce, nor whether they will pay the present high wages at the same time as they presumably enter into competition with private industry, but he evidently approves of the idea of "control" to the

extent that Government ownership will give it. Our impression is that Government ownership will really mean, in the long run, "control" by the workers. Mr. Barnes would run our industries in such a way that they would produce the greatest possible output of goods, under the most scientific conditions of labour, in order to get the largest possible wages and the best conditions of life in those industries. We do not pretend to regard these general aspirations as new; indeed, they have become almost platitudes to-day. What they need is a little more elaboration, so that we may understand exactly what it is that our national leaders propose for assisting the situation with which shortly we may be faced. As a matter of fact, we confess that the whole outlook industrially, so far as wages and conditions are concerned, seems to be about as confused as it has been at any time during the past four years. We are continually feeling our way through periods of industrial unrest without any actual remedy emerging, and sometimes it appears as though we shall be able to do little, except try to create "an atmosphere," until all the new difficulties that are now accumulating crowd upon us. We do not wish to minimise the value of the work that has been done in setting up Industrial Councils. We hope that much good will result from the series of district conferences that the National Alliance of Employers and Employed is holding in different parts of the country this autumn to promote industrial unity, and from events of a similar kind that the Industrial Reconstruction Council is holding in London, but the issuance of the manifesto by the Alliance seems to us to show pretty plainly that there is a strong representative opinion that something more than conferences, discussions, and pamphleteering is needed, and that without any further delay.

The Alliance has been considering the increasingly serious industrial unrest in the country, and the "tendencies which it reveals." It sees the great danger that exists through disputes being allowed to drift until the workers are forced to the conclusion that the "strike" is the only means by which they can establish their claims. It holds that the stage has been reached when "it is a question not so much of the long-standing and gradually accumulating causes of unrest as of the methods by means of which the whole industrial situation is to be handled." The want of co-ordination of Government industrial policy is creating a spirit of alienation and distrust between employers and workpeople on the one side, and the forces with which they should co-operate, on the other. Such a situation it is considered is "full of perilous possibilities." This being so, there should be "a definite and consistent Government policy—a policy not of drift but of prevention," and inasmuch as "Industrial peace cannot be secured by legal enactment, but in industry there can be peace by negotiation," the Alliance calls upon the Government to summon a round table conference of employers and employed and representatives of Government Departments concerned. The suggestion is made with a view to securing that "employers and employed are brought together on terms of equality to formulate and give effect to an industrial reconstruction policy in conjunction with the State."

This demand of the Alliance comes from a representative organisation of industrial authorities acting in conjunction with certain Labour leaders, and as its fears appear to coincide fairly approximately with our own concerning the result that has so far attended our efforts at industrial conciliation, it has our support.

The Prime Minister, in his Manchester speech, has indicated that his heart is with the people in their struggles, but he is not swayed merely by sentiment. "Comfort is the surest preventative of anarchy, but comfort involves plenty. You can ensure plenty by ensuring the best conditions for production. If abundance is not there you cannot distribute it. . . . The State must help to promote and encourage production. It must remove hindrances to production, and ensure confidence and serenity, which are essential to production." Mr. Lloyd George holds that it would be a mistake, indeed impossible, to attempt a statement of detailed plans in this hour, crowded as it is with other and more important concerns. Experts are studying the problems of reconstruction so that when the war is over the nation will not lose time in setting its house in order. The moment the struggle is over the work of reconstruction must begin—it must proceed while the national limbs are supple with endeavour, under the influence of patriotism and sacrifice, and with the momentum of victory behind it. The Premier's sentiments were characteristically strong and earnest, and we believe that ultimately he will, to the confusion of his opponents and critics who have been watching for an opportunity to "entangle him in his talk," be able to lead the nation sanely on to safer, surer ground for the future, but, busily engaged as the Government is upon matters of momentous concern, we believe that it would do well to pay heed to the suggestion of the Alliance. We have to win the war at all costs, but the ultimate good of the nation will assuredly be imperilled if we are only able to temporarily maintain our Home Front firm by facilitating "the rake's progress."

Power House Operation and Maintenance.

In these days of general retrenchment and national economy, a question of the first importance is that of turbine and boiler-house operation and maintenance. There is no doubt that many improvements and material economies have been effected within the last few years, and that efforts are still being directed to that end. In this connection valuable assistance can be gained from the experience of other engineers, and we commend to the notice of our readers the recent paper by Messrs. T. G. Otley and V. Pickles, on turbine-house plant operation (abstracted in our issues of August 30th and September 6th, 1918). Our readers will also remember a former paper by the same authors on boiler-house operation and maintenance (abstracted in the Electrical Review of February 9th, 16th, and 23rd, 1917). These papers furnish ample food for thought; the matter contained in them is worthy of careful reading and consideration by all who are interested in power house operation.

It is to be feared that in many undertakings there is not sufficient co-operation between the turbine-house staff and the boiler-house staff; each works more or less as a separate unit, independently of the other, whereas to obtain the best running conditions and the highest efficiencies the turbine and boiler should be regarded and operated as one unit. At one station that we have in mind, which takes up the large load variations of the system with which it is associated, the switchboard staff is in direct communication with the boiler-house staff by a code of signals. By this means the two staffs are able to co-operate and adjust their operations to suit one another's requirements.

The most important factors affecting boiler efficiency are the varying character, energy value, and size of the coal burnt. It has often been stated that it is possible to obtain the same efficiency with low as with high-value coal. In commercial working this is impossible, even with the same CO_2 and uptake temperatures. Load factor has a considerable effect on the efficiency of operation, but "utility" factor has also a powerful influence. For instance, a 100,000-kw. station, which has to be prepared to supply that load if required, though it is never actually called upon to do so, may have a load factor of 80 per cent., even though the maximum load called for is only, say, 50,000 kw. The utility factor is relatively low, although the load factor is high. Boiler maintenance is of equal importance to boiler operation in obtaining high efficiencies. It has been proved by experiment that the thermal resistance of the gas film accounts for between 95 and 98 per cent. of the total temperature drop from the furnace to the water. It is evident, therefore, that the external cleanliness of the tubes plays a very important part in boiler efficiency, indeed, much more so than a layer of scale of any reasonable thickness on the inside of the tubes. Again, the provision for dealing with ashes is often a minor factor in station design, but the efficient handling of ashes is a matter of the first importance at a power station running at a high load factor and burning any considerable tonnage of coal, especially when the coal contains a high percentage of ash, as at present.

There are many sources of waste which are avoidable; to facilitate their detection, full use should be made

of recorders, gauges, and meters. Coal-weighing leads to many direct and indirect economies. To maintain efficiency, continual records of performance must be kept, especially as every condition of operation is variable. The heating surfaces demand very frequent and careful attention if maximum efficiency is to be obtained. The superheaters are specially important, because every 10° F. superheat lowers the steam consumption of turbines about 1 per cent. Observations showing the distribution of draught often give valuable information concerning defects or unfavourable conditions. After ensuring that as much as possible of the thermal value of the coal gets into the steam, it is desirable that losses in other parts of the installation—*e.g.*, the condenser—be kept as low as possible. It cannot be too strongly emphasised that the performances of boiler and furnace are distinct phenomena; the furnace produces heat, and the boiler utilises it. Continual vigilance is needed to maintain efficiency, and everything depends ultimately upon the personal factor and upon "team work." The importance of this matter is such that the U.S.A. Government is taking steps to ascertain the efficiency of power plant with a view to eliminating wasteful plant and giving preference in coal supply to the most efficient installations.

Turning to the second and more recent paper to which we have referred above, in which the authors discuss some of the salient points connected with the efficient operation of turbine plant and its attendant auxiliaries, it may be said that the modern turbine has been developed to such a point that little can be done to increase its economy.

Within the range over which a turbine is commercially operated, its efficiency rises with the load it carries, but it does not follow that it is most economically loaded at its normal full rated capacity. Maximum economy is reached, according to the authors, when the product of turbine and steam efficiencies is greatest; and as the steam efficiency falls with a rising load, this product may be greatest at some point below its full rated capacity. In general, however, we may assume that it pays to run with as high a plant load factor as possible. Steam efficiency is the variable which has to be given the greatest attention. This is dependent on boiler-house operation and the efficiency and maintenance of the condensing plant. It has been found by test that the over-all efficiency is affected to the extent of 1 per cent. by a change of one atmosphere in the steam pressure. Further, it has been shown—again by test—that if the initial temperature of the steam is increased by 7° C., another 1 per cent. in over-all efficiency results. We quote the results of these tests as confirmation of the importance of supplying turbines with steam at as high a pressure, and especially at as high a temperature, as possible.

Special attention should be given to condensing auxiliaries, and care should always be taken to get the best possible service out of the plant; it should be run at all times at as high a speed as possible. Some time ago the authors of the paper referred to went very closely into the performance of their condensers, and a number of experiments were made to ascertain whether the efficiency of the plant supplied could be improved. It was found that improvements could undoubtedly be made, but once a plant of this kind has left the factory it is too late to make radical alterations with a view to improving its design or construction.

Efficiency in the operation of any station can only be attained by close supervision. Although the same supervision cannot be exercised in commercial operation as in a test, the operating data recorded should be sufficient and accurate enough to enable a reliable opinion of the performance of the plant to be formed. The steam used in the turbines is the most difficult thing to measure. It is stated that none of the ordinary forms of water meter that have been tried in South African stations gave sufficiently accurate or constant figures, and special apparatus had to be evolved, which again shows that improvements can be made if set about in the right manner.

In times of stress like the present the Government calls to its aid the entire engineering strength of the country. There is no stinting of public money for experimental work in connection with the war, and it is now realised that the work of the engineer is one of the principal factors in the conflict. National greatness and strength in war are dependent on the energies of a people in peace time, and, as is the case to-day, so also in normal times it is the engineer, using the term in its broadest sense, who plays the principal part in national greatness. This leads to the conclusion which the authors have come to, that while to one man or one firm of manufacturers, the decision whether he will risk his reputation or they their financial position by a radical change in engineering practice is a very great undertaking, to a Government such a burden is a light one. They submit, therefore, that pioneer work of this description, when endorsed by a representative Institution or Committee, should cheerfully be undertaken by the Government as a national obligation. We trust that the Fuel Research Board established by the Scientific and Industrial Research Department will translate this thought into action, and that its investigations will be productive of many improvements both in apparatus and in operation, to the great advantage of the State and of the individual.

Electricity and Steel Testing.

It is a commonplace that electricity is playing a prominent part in almost every field of industrial activity nowadays; it may not, however, be so generally realised that its capabilities are being continually extended in quite unexpected directions, and that it is, in fact, a sort of Admirable Crichton, of infinite resourcefulness and inexhaustible possibilities.

In our issue of October 19th, 1917, we described a new method of testing steel which had been evolved in the United States, depending on the fact that the magnetic and mechanical properties of a certain grade of steel were definitely correlated, so that one might be taken as a criterion of the other. The special virtue of this method was that it did not involve the slightest interference with the article under test, an important consideration, and one which is shared by no other mode of testing. The method can also, therefore, be applied from time to time to the articles in service, to determine their condition, thus avoiding the premature renewal of parts which are perfectly sound, or, on the other hand, preventing disaster through their unduly early deterioration. Further examples of the uses of electrical tests were brought forward at the meeting of the Iron and Steel Institute last week, in papers read by Mr. Kôtaro Honda and Mr. E. D. Campbell. The remarkable change in the molecular constitution of steel at the temperature of recalescence, with a simultaneous loss of its magnetic properties, has for some years been utilised in connection with the hardening of steel, and is the basis of the Wild-Barfield electric hardening furnace, which ingeniously utilises the disappearance of the magnetism to indicate the attainment of this critical temperature; Mr. Honda has further developed the application of this principle, by determining the critical points and transformation points of various constituents of steels, and finds it possible to conduct a magnetic analysis of steel and to trace the changes in its structure which accompany changes in temperature. No doubt the method has its limitations, but it will prove a most valuable supplement to photomicrographic examination and chemical analysis, and who can tell to what the system may lead? Congratulations are due to the author and his colleagues, who have carried out an arduous and extremely detailed investigation with notable success.

Mr. Campbell's paper related to the electrical resistance of hardened steel, a subject which has engaged the attention of metallurgical chemists for many years, and forms part of a prolonged series of investigations on the resistivity of steels; it deals with the rate of change of the resistivity at 100° C. and at ordinary temperatures, due to the reaction which takes place in the unstable solid solutions which constitute hardened steels. At 100° C. changes are observed in the course of a few hours far greater than take place at room temperature in as many months. Such researches continually add to our knowledge of the structure of steel—a matter of immense importance, in view of the part that class of alloys plays in every department of engineering and industry.

NOTES ON THE ACTION OF AUTOMATIC PROTECTIVE GEAR ON A LARGE A.C. NETWORK.

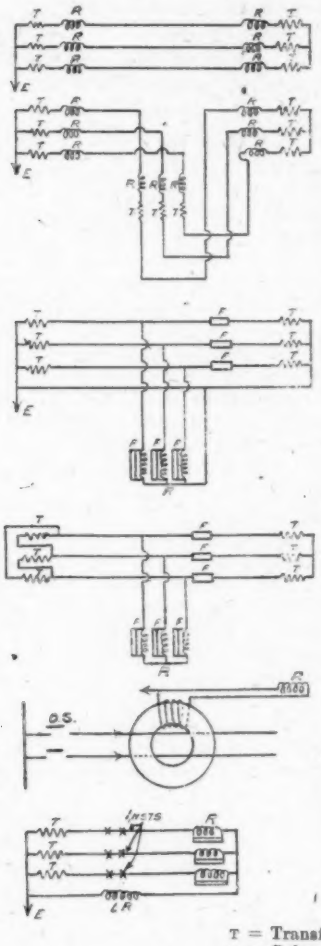
By C. W. MARSHALL.

THE maintenance of continuity of supply on large electricity supply systems is at all times of vital importance, and the estimated financial loss due to interruption of supply on the network referred to in this article is in the region of £600 per minute. This loss is based on the assumption that a general shut-down occurs during factory working hours. It does not include any of the great material losses which sometimes occur in gun factories, paper works, &c. This consideration has led broad-minded managers of supply undertakings to be willing, in normal times, to risk sacrificing their own machines, if necessary, in order to obtain a high degree of continuity.

At the present time it is necessary to preserve continuity with the minimum of danger to plant of all kinds, and accordingly a compromise between stability and sensitiveness of the protective devices must be made.

These notes are based on the results of some years' working, and the various classes of plant are treated separately, beginning with the source of supply. The alternators, which vary in capacity from 4,000 K.V.A. to 7,000 K.V.A., are all protected on the Merz-Price circulating-current system, and the gear has been tested on several occasions under both internal and external fault conditions. The relays originally fitted were of low impedance, and although the transformers were very well balanced, it was found impossible to prevent the machines from being tripped out under heavy external short circuits without using fuses in parallel with each relay element. Later on, new relays of high impedance were substituted for the original equipment, and the machines are now running with settings of from 10 per cent. to 20 per cent. of full-load current, with very satisfactory results.

It must be noted, however, that although the machines have come through many severe external faults, it is by no means certain that they would not come off the bus-bars if a fault were to develop in the immediate neighbourhood of the power stations. Experience has shown that with a setting of 50 per cent. and a time lag of about ½ second, a faulty machine could be disconnected from the bus-bars without great disturbance, but that the damage done to the windings was such as to necessitate complete renewal of both stator and rotor windings. In the cases mentioned no automatic field-breaking device was fitted. With an instantaneous setting of 10 per cent. a faulty alternator has been cut off without causing the slightest trouble, and the damage to the machine was confined to one stator coil. Here again the field circuit was merely broken by hand. The general conclusions drawn are that while Merz-Price gear gives a satisfactory degree of protection from the standpoint of sensitiveness, it leaves much to be desired in stability, and, wherever practicable, one of the more recent developments, such as the self-balance gear, as used by Beard, or the lately patented method of A. E. McColl, should be adopted. This latter method is of very general application, and fault settings of 5 per cent., and even less, can be used, without any danger of instability; with these sensitive settings it ought to be quite satisfactory to use field-breaking devices on the exciter alone, thus effecting very considerable economies in the first cost of the gear.



No.	System.	Current transformer.	Relays.	Remarks.
1.	Merz-Price feeders. Voltage balance.	Single air-gap type 400/1 B.T.H. 590/1 Reyrolle.	Moving iron, 0·1 amp.	Approximate fault current, 100-200 amps. Liable to trip sound sections if fault currents are great.
2.	Merz-Price T's.	Do.	Do.	Do. Pilots 3/20
3.	Merz-Price circulating current protection for generator and Y/Y transformers.	Ordinary instrument type, 5 A. secondary.	Do. 3-12 A. transformers, 0·05 A. generators.	Pilots 7/21½ 4-core. Series fuses for transformers only.
4.	Circulating current protection for △/Y transformers.	Ordinary instrument type, secondary △ 2·89 A. Y 5 A.	Do.	Do.
5.	Merz-Hunter split conductor.	Special double primary.	Moving iron, 0·05 A.	Fault current 10 A. Note split switch.
6.	Wedmore core balance.	Ordinary instrument type. 5 A. secondary.	Do.	For tail ends only.

T = Transformer secondary.
R = Relay operating coil.
F = Fuse.
Secondary conductor only shown, except in 5.
O.S. = Oil switch. One phase only shown.

In protecting feeders Merz-Price balanced voltage gear has done quite good work, but it is somewhat deficient both in sensitiveness and stability. The general experience has been to the effect that Merz-Price gear on cables cannot be depended upon to cut out a defective cable before a short circuit between phases has developed, and that the rush of current to the fault is often sufficient to disconnect sound sections protected on the same system. Split-conductor protection, both with split-concentric and six-core cables, has proved to be extremely satisfactory in both the above respects. So far as rather limited experience shows, faulty sections can be cleared without causing the slightest disturbance, and there is no danger of the relays operating under even the severest straight-through faults. Where existing cables are grouped to form split conductors, it is very difficult to obtain exact balance, and biased relays are desirable. It is worthy of note that all cable faults occurring at distances corresponding to ohmic resistances of 0·2 ohm and over (from the power stations) have been cleared without damaging the oil switches to any serious extent. This fact, taken in conjunction with the amount of plant running at the time of the fault, usually about 40,000 KW., and the inherent reactance of the machines, about 5 per cent., gives a valuable guide to the size of the zones into which the system ought to be subdivided in order to ensure faults being cleared without destroying the oil switches. Another noteworthy fact connected with faults beyond the 0·2-ohm limit is that they have invariably been cleared without disturbing the running of the synchronous machinery, even though the minimum time in which the relays could operate was in some cases 0·8 second.

Transformers protected on the circulating-current system have necessarily parallel fuses for use in conjunction with the relays, and although the degree of protection is fairly high, the writer is of opinion that it would be advisable to discard the system entirely in favour of McColl's. The most important practical point experienced by the writer is that the best method of dealing with the well-known connection troubles in delta/star jobs, is to fix rigidly the standard connections, mark the polarity of all current transformers, and use coloured wiring. Any error on the part of wiremen should then be distinguished without difficulty.

Leakage Protection, fig. 1 (6), has proved very useful. Although it was found necessary to standardise 100 per cent. fault setting, the extremely rapid action of the relays is generally sufficient to clear faulty apparatus without doing much damage, or disturbing the running of the sound parts of the system. The application of leakage to H.T. motor windings should not be relied on too much, as quite recently two cases occurred in which large motors developed faults between phases. Due to the fact that there was no earth in either case, the leakage relays did not act. The machines were cleared by comparatively slow acting overload devices, causing very severe shocks to the system and great damage to the windings.

Taken as a whole, it appears that the conventional devices, as outlined above, are a very sound investment. It seems to the writer that far more should be done to encourage the adoption of less known schemes, even though they involve considerable expenditure of capital. For instance, the sheath system proposed by the late F. B. Whitaker, if properly developed, would give complete protection to the bus-bars as well as the cables, with almost no possibility of dead short circuits occurring.

In order to ensure that protective gear gets a fair chance of operating to the best advantage, it should be the aim of the managements of supply companies to enlist the active co-operation of all members of their staffs. The writer suggests that it would be advantageous to withdraw the keener shift engineers from their routine work for, say, one or two months each year, and employ them on erection and testing connected with the various types of gear. It is contended that this would stimulate their interest in the apparatus, and would also prove an interesting relief from what is generally acknowledged to be an extremely dull and initiative-destroying form of employment.

Diagram 1 gives the essential connections of the systems referred to in the paper.

In conclusion, it would be invaluable to those interested in the maintenance of continuous supply if electricity supply companies and municipalities would publish annually a statement of all faults occurring on their systems. This aspect of their work is almost as important as the financial side, and it would be extremely beneficial if there was healthy rivalry between authorities as to which area should have the best record of immunity from shut-downs.

THE ELECTRICAL INDUSTRY IN RUSSIA.

By ALLAN MONKHOUSE, Jun., A.M.I.E.E., A.Am.I.E.E.

At the present moment industry in Russia is at a complete standstill; nevertheless, it may be of interest to review briefly the advance made in the electrical industry in that country up to a few months ago, when civil war and anarchy caused the temporary closing down of the works. The re-opening of these works is merely a matter of time, and once law and order are restored in Russia the possibilities for electrical development in such a vast country, abounding with natural resources, will be enormous.

Heavy Machinery, Motors, &c.

There are four large works in Russia engaged on the manufacture of heavy electrical plant.

(*a*) The Russian A.E.G. Co.'s works, previously at Riga, and now evacuated to Kharkoff. Before the war this firm, like the Russian Siemens-Schuckert Co. and the Russian Siemens-Halske Co., was in actual fact more like a department of the Berlin firm of the same name. Most of the designing and technical work was done in Berlin, and nothing but the simplest machines were built in Russia. The Russian A.E.G. Co., in fact, used to employ its Riga works very largely as an assembling shop for Berlin-made machines. In this way, besides avoiding the heavy Customs duties on finished machinery, it was enabled to make a selling point by stating that its machines were Russian built. At the outbreak of the war, this firm, together with the other two mentioned, wasted no time in denouncing all connection with the Berlin firm and publicly advertising that its shares were held entirely by Russian subjects, and that it was associated with the G.E.C. of America. The evacuation of Riga practically shut down the works for a time; however, the works were reopened in 1915, in Kharkoff, where the firm has erected extensive new works capable of employing 10,000 men, and designed to build all classes of electrical machinery. A new shop is under construction for the manufacture of turbo-alternator sets complete. This firm has had great difficulty in living down its previous connection with Berlin, and as lately as last year the managing director of the works was reported as having been arrested on a charge of being an enemy alien.

(*b*) The "Volta" company at Reval has a modern, well-equipped plant. This firm was chiefly engaged on large Admiralty work, and enjoyed a good reputation. The works have the advantage of being situated in Esthonia, where the quality of the labour obtainable is very considerably superior to that obtainable in Russia proper. Although a Russian-owned concern, the organisation of the works is based on German lines, and, in fact, the internal correspondence, drawings, and works specifications are all couched in the German language.

(*c*) The Russian Siemens-Schuckert Co. has a works in Petrograd which were previously chiefly employed in assembling and building traction equipments and small motors. Since the outbreak of war, the works have been considerably enlarged for dealing with larger work.

(*d*) The Russian Electrical Co. "Dynamo" is a firm founded in 1912 with purely Russian capital and incorporating the business of the N. Glehoff Co., whose works were destroyed by fire in 1911, and Messrs. M. M. Podobedoff & Co.'s contracting department. This firm bought up the works of the Russian Westinghouse Co. in Moscow, which it considerably enlarged, and commenced the manufacture of all classes of heavy electrical machinery. A special traction department was laid down to manufacture

railway equipment to the designs of Messrs. Dick, Kerr and Co. The "Dynamo" Co. later became the sole agents for Russia for the British Westinghouse Electric and Manufacturing Co., and the Westinghouse Companies of Italy and America. After the outbreak of war the company made enormous developments to its works. New works were built for making oil switches and switchgear of all kinds, lamp fittings, and porcelain insulators. The firm also put down two large shell works, and a department for making wire cutters and other military requirements. In 1915 the firm built several 600-KW., 1,500-volt direct-current generators for railway work, an accomplishment which was considered a distinct advance in Russian electrical manufacturing. The Moscow works include a large oil engine department, making a good engine of the Hornsby type.

Amongst other firms which, although not having works in Russia, did considerable trade with that country, and are, consequently, well known to the Russian buyers, may be mentioned Bergmann Co., Dick, Kerr & Co. (for traction equipments, &c.), Brown, Boveri & Co., Oerlikon Co., and the Swedish General Electric Co. (A.S.E.A.).

Cable-Making.

The cable-making industry had advanced probably further than any other branch of electrical work in Russia. The Russian Cable and Metal Rolling Co.'s works in Moscow started operations in 1912, and is associated with the "Dynamo" Co. This firm was a joint development of the M. M. Podobedoff Co., which had been manufacturing light insulated wire for some years, and of the British Insulated and Helsby Cable Co. The firm made enormous developments during the early part of the war, and, finding itself hampered by the impossibility of obtaining machinery, it undauntedly put down a small workshop, and a few weeks from the commencement of hostilities it was itself constructing all the plant necessary for drawing, stranding, and insulating field telephone wire. Eventually the plant was turning out 1,000 verts of this wire per day. Plant was also laid down for manufacturing enamelled wire, and, just prior to the revolution, a large reverberatory furnace department was added to the works for treating copper scrap. The firm has a large department for making heavy paper-insulated power cables and telephone cables. In 1913 the firm completed orders for 1,100 pair paper-insulated, lead-covered telephone cable, thus creating a record for large telephone cables in Russia. Other cable and wire manufacturers of equal importance are Veshnakoff, Shaamshin, & Alexieff, in Moscow, the Kolchugin Co., near Moscow, and the United Cable works in Petrograd.

All the cable makers were formed into a combine operating under the name of "Electroprovod," which combine controlled the whole cable-making industry. All orders were placed through it, and were divided out between the works in accordance with a definite agreement.

Electrical Instruments and Small Apparatus.

Previously to the war the German manufacturers held this field almost completely in their hands. It was an exception to find anything but German switchboard apparatus anywhere except on a number of installations made by the Russian Westinghouse Co., where British and American instruments were used. For laboratory work Weston instruments are, and always have been, regarded as the standard.

The A.E.G. Co., Siemens & Halske, Hartmann and Braun, Kaiserwetter, and Paul Meyer may be mentioned amongst those firms which had an enormous trade with Russia. The latter three firms had no works in Russia, but had most energetic agents all over the country. These firms produced attractive catalogues, and not infrequently altered their designs to suit Russian conditions—a procedure which, it is regrettable to say, it was found, generally speaking, British manufacturers were very unwilling to follow. Messrs. Siemens & Halske commenced assembling measuring instruments in Petrograd to comply with the Russian Admiralty injuction that, wherever possible, the Naval Departments should give preference to Russian-made materials in placing orders. A firm under the name of Engineer Petch in Warsaw commenced instrument making, but apparently abandoned the attempt after the outbreak of war. The Bureau of Electrical Measuring Instruments in Petrograd also commenced the manufacture of instruments in 1915, but its efforts were not crowned with great success. The most serious attempt to manufacture this kind of apparatus in Russia was made by a British firm in Moscow, which had succeeded in putting the manufacture of moving iron instruments and small switchgear on a thoroughly good basis. This firm's plant was being extended to manufacture special switchgear and auxiliary apparatus for naval requirements when the works were shut down in March last, on the British Colony being instructed to leave Moscow.

Telegraphic Apparatus.

The telegraph apparatus business in Russia was largely in the hands of Messrs. Siemens & Halske. The chief buyers of this kind of apparatus were the Government Telegraph Departments and the railways. The Russian Siemens & Halske Co. has, since the war, put down a large new, well-equipped works at Nijni Novgorod for the manufacture of telegraph and telephone apparatus. The works were hardly in full operation when the reign of anarchy began. The Moscow Telephone Manufacturing Co. had also just equipped works in Moscow for the manufacture of telegraph and telephone apparatus, but as it was at these very works that the Bolshevik Red Guards were first formed for the *coup d'état* of November last, it is hardly probable that much remains of the works organisation.

Telephone Apparatus.

The telephone business in Russia is almost entirely in Swedish hands, through the Ericsson companies, which had a very large works in Petrograd, and which also controlled the telephone stations of Petrograd and Moscow, and other large towns. The Moscow telephone system was unquestionably one of the finest in the world, and until January, 1917, it was controlled and managed by Swedish engineers. During the Bolshevik bombardment in November last the entire system was "burnt out" by someone maliciously connecting the 220-volt A.C. mains on to the operating boards.

Accumulators and Dry Cells.

There were several firms engaged in the manufacture of accumulators, but unquestionably the Tudor Co. was the most important. After the outbreak of war, five or six small works were started in the Moscow district, exclusively directed to manufacturing dry cells for pocket lamps—a soldier's commodity for which there was a very large demand. It should be said that the majority of these cells were hardly satisfactory in operation, rarely "holding up" for any reasonable period.

Lamps.

Several firms in the Moscow district were engaged on the manufacture of lamps, chief amongst which the works of Engineer Kalmanok may be mentioned. The lamps manufactured and the smallness of the output, however, were such that these works could hardly be expected to compete with foreign manufacturers under anything but war conditions.

Electromedical Apparatus.

Previously to the war, no attempt was made to make electromedical apparatus in Russia, but the enormous requirements of the war led to a start being made by several firms. Messrs. Russian Siemens & Halske Co., Mr. Vertsalnik, of Moscow, and Mr. H. Ledward, whose workshops and laboratory are in Moscow may be mentioned amongst those who were developing this work rapidly. The last-named had also started the manufacture of X-ray screens with highly satisfactory results. X-ray tubes were being made by Engineer Fedeoroffski's works in Petrograd.

Insulation Materials.

In the manufacture of porcelain ware and insulators the "Isolator" Works in Moscow and the "Dynamo" Co.'s Works were producing articles which were equally as good as any foreign products, and, moreover, the cost of manufacturing was so low that, were proper trade channels open,

these works could most effectively compete with British makers, especially for the simpler kinds of insulators.

Although Russia has a very large firm engaged in rubber manufacturing, its products have never proved successful from an electrical point of view. This, however, may be attributed to the technical personnel of the works being hardly acquainted with what is required for a good dielectric insulation, since there is no question that the splendid modern equipment of the works should be able to produce the article required.

Recently an attempt was made to manufacture a product similar to "Bakelite," under the name of "Carbolite." This was a moderately good substitute, but rather brittle. The Russian A.E.G. Co. also makes an insulation under the name of "Rigolite," which it is trying to substitute for "Stabilit."

Experiments have also been made with Siberian mica splittings. This mica is of good quality, and there is no doubt that, with proper equipment and experienced supervision, a good grade of micanite could be made in Russia from local mica.

From the above summary of the state of the electrical industry in Russia, it will be seen that the war had a great stimulating effect in the development of new industries. Before the war the German manufacturers, with their splendid selling organisation, good catalogues in the Russian language, rapid deliveries from stock, and their system of long credits, had practically monopolised the electrical trade in Russia. When Russia found herself suddenly cut off from her supplies, British, Swedish, and American firms began to fill the place left by the Germans, but the difficulties of shipment and in obtaining valuta made business so difficult, that the Russian manufacturers were everywhere tempted to risk the new developments.

The greatest difficulty was in obtaining the necessary skilled labour and supervision. The Russian workman can seldom be sufficiently trusted to be left without the closest supervision. For instance, in armature winding it is a matter of the greatest difficulty to teach men to have even an inkling of what purpose insulation is intended to serve. It was quite a common occurrence to find men driving former-wound coils into armature slots with a fitter's hammer, fondly imagining that so long as the Leatheroid packing piece covered up the obviously-damaged insulation of the coil they would escape detection. For the finer work, however, excellent labour was found by employing silversmiths, who could be obtained easily since their own trade had been hard hit by the war, and the men were very glad to find employment, especially on war work, where they could secure exemptions. Female labour is fairly good, and for winding and fine work is unquestionably superior to male labour. Some works tried to employ Letts and Esthonians on the more delicate and difficult work, but this was an arrangement that always resulted in serious quarrels with the Russian workers. Generally speaking, however, there is no question that excellent semi-skilled labour is obtainable in Russia, but such labour requires the closest supervision.

Some difficulty had been experienced during the war in obtaining raw materials, especially armature iron and insulation materials. The various Ural ironworks have, however, now managed to produce an iron which, when tested at the Moscow Municipal Testing Station, showed most excellent results in comparison with the best British makes. Cast-steel for traction motor frames was another great difficulty, and as nothing could be obtained to equal the products of Sheffield and Middlesbrough makers, it was found necessary to thicken up the frames to obtain the required results with Russian steels.

Drop forgings were almost impossible to obtain, and as there are only two works in Russia making a speciality of the manufacture of malleable iron castings, it was very frequently found necessary to alter designs to employ cast brass and thicker cast-iron parts where malleable iron would otherwise have been used. Latterly one works was casting a cast-iron with 30—35 per cent. old wrought-iron scrap in it for use instead of malleable iron.

At the present moment almost all the works named are shut down, due to want of materials, fuel, supervision, or for financial reasons, and it is difficult to say when they may be reopened, but there is no question about it that when Russia does outgrow the present period of adolescence through which she is passing, and takes her place among the nations, there are unlimited possibilities for industrial development to be found in that country.

The one thing Russia lacks is *practical* technical education—the very trait strongest amongst British engineers. Up till now it is a fact that wherever British engineers and technical men have been in charge of industry in Russia their efforts have been crowned with success. The textile industry in Russia is in itself sufficient proof of this statement.

Germany as a nation is not interested in developing Russia industrially, since, having no Colonies of her own, she wishes to keep Russia as a "colony" for her export trade. The terms of the Brest-Litovsk treaty clearly proved this fact. It is questionable if Russia can reorganise her industry without outside assistance, and it is to be hoped that British capital and British engineers may realise this when the present state of anarchy passes, and thus help to prevent Russia again becoming a dumping ground for German goods.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electric Crane Tractor.

We learn from the Electric Vehicle Section of the National Electric Light Association, New York, that a Chicago manufacturer of electric vehicles recently placed on the market an electric tractor equipped with a 2-ton capacity crane, also operated electrically, and supplied with energy from the same storage battery as was used to propel the vehicle. The demand for this mobile electric tractor crane was created principally through war conditions, and although it has not as high a lifting capacity as many locomotive and overhead cranes, it has the advantage of being more flexible in its radius of action. Recently one of these electric crane tractors was observed unloading a freight car at a well-known terminal. It was handling large crates of army kitchen equipment weighing approximately 3,700 lb. After lifting the cases off the freight car, it backed away, and running across the pier under its own power, deposited its load. While this is a somewhat larger load than the vehicle was designed to

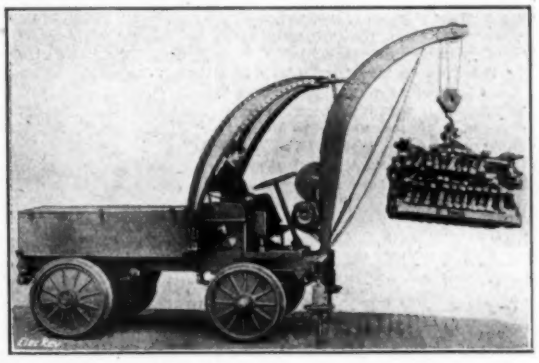


Fig. 1.—Electric Crane Tractor.

carry while in motion (the manufacturers would prefer loads to be limited to 2,000 or 3,000 lb. in such instances, the ordinary stationary crane having only a maximum capacity of 4,000 lb.), the tractor performed its duty easily. The boom of the crane swings through 180°, so that after material is lifted it can be deposited easily on the ground or on a trailer for transportation elsewhere. It can be readily realised that speed in handling material is of importance under present conditions. Locomotive or overhead cranes are not always available at just the place where it is necessary to handle material at a given time, and even if available, they cannot always be transported quickly from one point to another as can an electric crane tractor of this type. The electric crane tractor is equipped with a spring draw-bar coupler at the rear of the frame. It is possible, therefore, to load trailers by means of the electric crane, and then haul these trailers electrically to another point and unload them. As a tractor it can haul a gross trailing load of 15 tons. Electric tractors of this

type have been used in many instances to "spot" loaded freight cars, either pulling or pushing them. This electric crane tractor is another member of the electric vehicle family, which contributes no small part in successful war operations, not only expediting the rapid and economic movement of material and munitions, but also releasing numbers of men otherwise needed. Many of these electric transportation units are being operated successfully by women.

A Trolley-head Adjuster.

We are informed that an appliance has been invented by Mr. W. H. Simmonds, of 31, Chancellor Road, West Dulwich, S.E. 21, whereby it is stated a considerable waste of time and labour can be saved in re-establishing the engagement of an overhead conductor with the trolley-sheave of electrically-propelled cars. To accomplish this object the contact sheave on the end of the trolley pole is provided with an adjuster pivotally supported on the spindle on which the contact-making sheave is mounted. This adjuster is constructed with a pair of horn-strips which diverge from one another in an outwardly radial direction from the central plane of the sheave. The adjuster is also provided with an arm extending approximately radially opposite to the horns, and to the extremity of the arm the usual rope is secured for disconnecting the trolley-sheave with its pole from the overhead conductor, allowing same to rise and make contact with the conductor.

To disconnect the trolley-sheave with its pole a downward pull is given on the rope which rocks the adjuster, bringing the horns of the latter into a more or less vertical position. Should, on swinging the pole round from one end of the car to the other, the pulley-sheave not register in a plane coinciding with the line of the overhead-conductor, by simply slackening the rope and allowing the pole to rise, the horns will either on one side or the other encounter the overhead conductor, causing the adjuster with its pulley sheave to rotate, thereby bringing it into true alignment with the conductor, and with a simultaneous slackening of the rope the pulley sheave groove will engage with the conductor and at the same time the conductor will force the adjuster backwards into its out-of-action position by means of a crossbar situated at the rear, which comes in contact with the under side of the conductor.

It is claimed that with such a device the trolley pole with its sheave can be instantly re-engaged with the conductor under any unfavourable conditions in the minimum amount of time.

The Davis Brazing Table.

We understand that the Davis Furnace Co., Diamond Foundry, Luton, Beds., is placing on the market a new form of self-contained gas-fired brazing table, which is especially suitable for certain toolmaker's work. The use of an outfit of this description, operating upon such an extremely convenient and cleanly fuel as gas, gives, it is claimed, certain advantages, amongst which we may mention: ease of manipulation, as the apparatus is ready for work immediately the work is laid on the table; exact control of temperature and the area to be heated; cleanliness, and consequently improved quality of work turned out; the work is also in clear view during the time the operation is in progress. Apart from the brazing of pipes, tubes, and similar work, the apparatus is very suitable for brazing tips on tools. The firebrick table is mounted upon a very strong cast-iron stand, provided with a lower or bracing shelf, a high-pressure blower being fixed upon the latter, complete with fast and loose pulleys, or alternatively a small electrically-driven machine for providing the air-blast required by the blowpipes. Each blowpipe is swivel-mounted on a pillar with suitable adjustment for height. Instantaneous lateral adjustment is provided by the vertical supporting pillars sliding on a machined bar of square section, fixed horizontally along the front of the table. Flexible metallic tubing, complete with separate main control cocks, is provided for the air and gas supplies.

A PORTABLE AUTOMATIC COAL-TRIMMING CONVEYOR.

The process of "coaling ship," which consists not only in getting the coal on board, but in conveying it to and filling the various bunkers, termed trimming, is always an operation requiring a large amount of hand labour. Part of the operation consists in transferring the coal from barges or other craft, or from shore to the latter. The portable automatic trimming conveyor herein described has been designed with the purpose of handling the coal with the minimum of labour, trimming it into all the bunkering spaces provided in steamers, reducing the cost, and displacing the hand labour required in the present bunkering system.

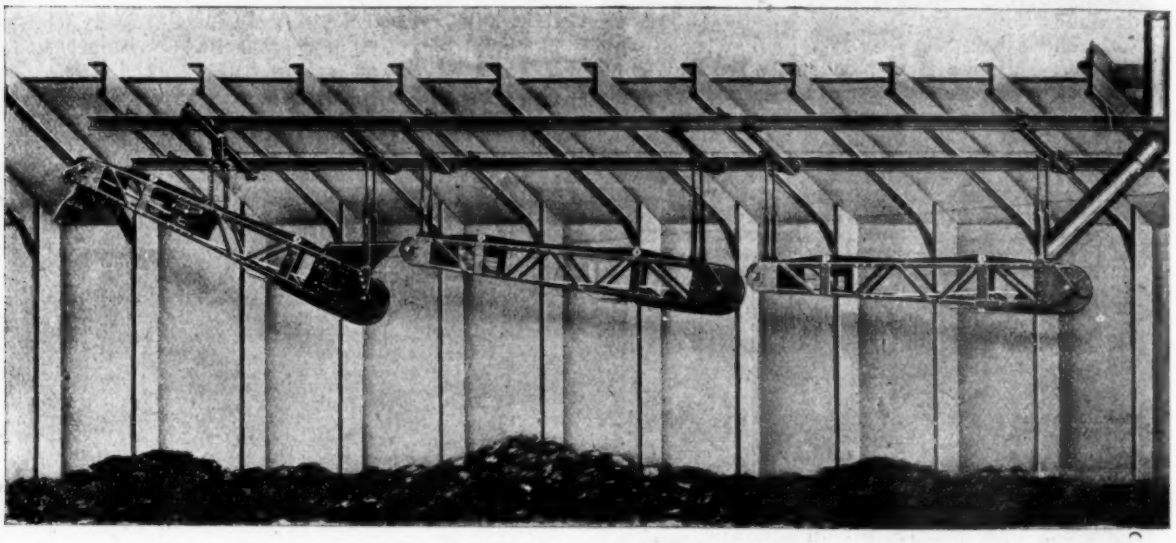


Fig. 1.—Portable Automatic Coal-Trimming Conveyor.

Fig. 1 illustrates the arrangement of the plant, which consists generally of a series of short self-contained conveyors, usually three in number, but depending upon the length of bunker, suspended from a pair of rails attached to the centre of the deck beams inside the bunker upon which the conveyors are free to travel longitudinally. The coal is delivered at one end of the series of conveyors by means of a shoot from the deck above, and is discharged at the other end by the trimming or front conveyor. This conveyor is provided with a lateral movement, so that the coal may be distributed over the whole width of the bunker, and is inclined sufficiently to throw the coal high enough to fill the bunker up to the top.

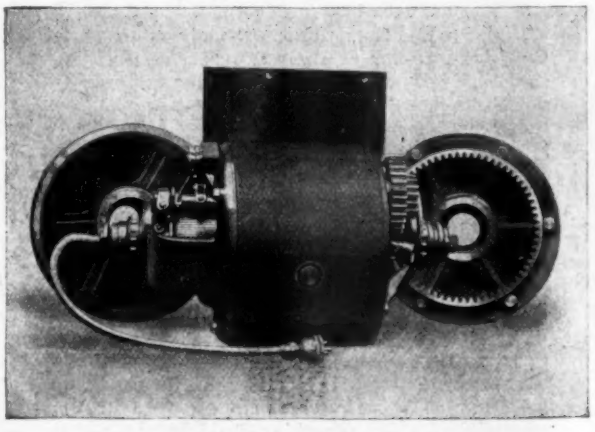


Fig. 2.—Driving Drum.

The conveyors are each driven by an electric motor situated inside, and forming part of, the end driving drum or terminal. The necessary lateral and longitudinal movements of the trimming conveyor are operated by mechanism from the driving motor, and both are automatic, the lateral movement being continuous, and the longitudinal movement being dependent upon the action of an ingenious device attached to the front of the conveyor, and consisting of a hanging plate

or shield, which is caused to move by the action of the coal piling up, thereby making an electrical contact which sets in motion a drum, and winds back the train of conveyors. When the end or tail conveyor has been backed beyond the delivery shoot, and is no longer required, it can be removed and fixed in another position. Coaling can then commence in another bunker, or several trains can be fitted up from a central delivery shoot, and the whole of the coaling proceed at the same time. When both sides of the ship must simultaneously be coaled, conveyors can be laid across the decks, or slung from gantries or cranes to the delivery hatch. In fact, it is claimed they can be adapted in any direction where material has to be shovelled, wheeled, or carried.

Another type of portable conveyor of the same general design as the trimming conveyor is mounted on swivelling

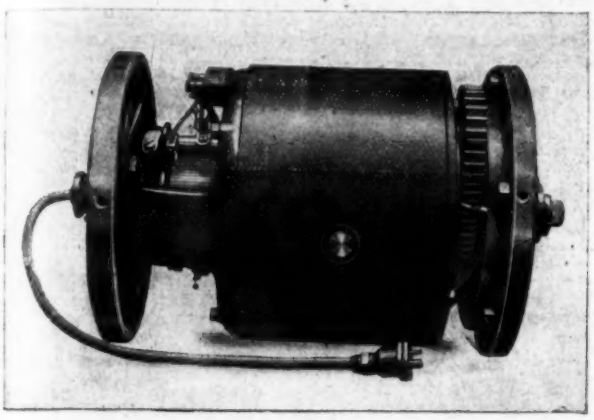


Fig. 3.—Driving Drum with Pulley Removed and End Brackets in Position.

castors for moving about the ship's deck, wharf, warehouse, or any other place where material has to be moved. These conveyors are also self-contained, and can be made in any desired length, and any number can be fitted up end to end, making a continuous train possibly several hundred feet in length.

The special feature of this conveying plant is the electric driving drum, of which the complete machine is illustrated in fig. 2. This driving drum consists of an electric motor of suitable horse-power, which can be wound for any commer-

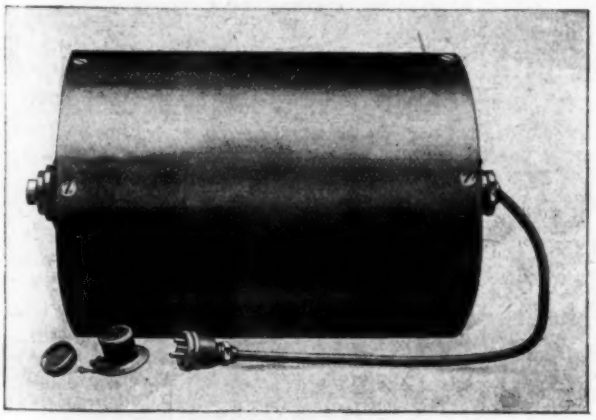


Fig. 4.—Motor Complete with Brackets, Pulley Removed. Removed.

cial voltage for either direct or alternating current. The whole of the outer drum which forms the belt pulley revolves and receives its power from an internal machine-cut gear wheel fixed to one of the end brackets that carry the drum, these brackets run on standard roller bearings. The internal gear wheel is connected by suitable spur and pinion with a pinion fixed on one end of the sleeve on which is also mounted the armature of the motor. The armature and driving pinion revolve on a hollow shaft to which is keyed the yoke and fields of the motor. The hollow shaft serves the double purpose of providing at one end a reservoir for the lubricant for the armature sleeve and gearing, and at the other a channel and protection for the cable connections. Both end brackets of the drum are solid, so that the machine becomes a totally enclosed motor protected from dust and damp, enabling it to be used under any weather conditions or in any situation.

Fig. 3 illustrates the driving drum with the pulley removed, the end brackets in position with the intermediate pinion, and the method of making the cable connections. Fig. 4 illustrates the parts of the driving drum showing the motor complete with both brackets and pulley removed, and making clear the whole design and construction of the machine.

The special self-contained motor and driving drum is adaptable for a great many purposes, such as elevators working in exposed positions, conveyors both above ground and underground in connection with coal mines, &c., portable stackers, loaders and pilers, and slat conveyors in connection with the mechanical handling of materials. It can also be used for haulage purposes, for driving winches, capstans, &c., replacing steam-driven machines working in exposed conditions.

The sole licensees and manufacturers of this labour-saving machine are Messrs. J. Martin Blair, 3-7, Southampton Street, Strand, W.C., and the motors are built for this firm by the Collins Electrical, Ltd., 115, Clerkenwell Road, E.C.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(*Concluded from p.* 248.)

Joseph Lucas, Ltd., Birmingham.—This firm's exhibit contained electric generating units for aircraft; a 12-volt aero electric engine starter weighing 10 lb.; a 12-volt tank starting and lighting equipment, the starter when fitted is geared to the engine fly-wheel. Three types of daylight signal-lamp outfits were included in the exhibit. In one type for use on patrol boats, aircraft, &c., the grip handle contains two spring triggers for operating the lamp, the lower one making contact with the battery, so long as it is pressed, and thus lighting the bulb. The upper trigger oscillates the mirror for the purpose of sending signals. This type of lamp is fitted with telescopic sight with adjustable eyepiece. In actual practice signals from this lamp have been read at a distance of 14 miles in daylight. A second type for use in maintaining and establishing communications in army zones where telepragh and telephone wires are cut by enemy fire, the signals are sent by means of the tapping key, which makes connection with the battery and lights up the bulb when depressed. A third lamp similar to the above, but somewhat larger, is fitted with a telescopic sight which has about two diameters magnification, and a total field of vision of about 4½ deg. The tube sight fitted to the side of the lamp is for night use, in case the telescopic sight becomes damaged. A narrow beam of light is projected for daylight signalling, and coast signals from this lamp have been read by battle-cruisers when twenty miles out at sea. This firm also had on view an interesting collection of electrically-heated articles of clothing such as a jacket, gloves, shoes, &c., for use on aircraft, together with a generating unit for heating the same. The dynamo is driven by an air screw, and switches are provided for operating the wireless apparatus, lamps, flares, Klaxon, and for heating the guns.

The Cleveland Magnesite & Refractory Co., Ltd., Normanby, Eston, Yorks.—The section devoted to ferrous metallurgy made the importance of the exhibition fairly obvious, for example, the exhibit of this firm contained samples of silica bricks and blocks for use for lining the interior and roofs of open-hearth steel furnaces, &c., and they are produced from high-quality ganister obtained from quarries in Weardale. An average analysis of the silica bricks produced by this firm is as follows:—Silica 95.12, alumina 1.60, lime 1.55, magneisa 0.27, iron peroxide 0.99, alkalis 0.34, loss on ignition 0.20. This company owns three brick works, two of which have been started since the war; women labour is largely employed, and the output is about 100,000 per week, in addition to magnesite bricks and cement.

Messrs. Ridge, Beedle & Co., Glasgow.—The usefulness of zirconia as a refractory material was illustrated by the exhibit of this firm of samples of zirconia brick for high temperature and resistance to chemical reaction. This is especially promising in connection with electric furnaces.

The National Physical Laboratory, Teddington.—These exhibits enabled the progress which has been made in certain directions to be measured with a reasonable approach to exactness. The metrology department exhibited various forms and types of gauges together with apparatus for testing and calibrating the same. The engineering department showed a mirror extensometer made at the N.P.L. This particular type has hitherto been made in Germany; it is an instrument of extreme sensitiveness and accuracy, can be adapted for all kinds of work where increases of length have to be measured, and is well suited for research work. From the metallurgy department came a set of samples of new light alloys of alluminium which have been developed and prepared at the N.P.L., including castings, ingots, and slabs suitable for rolling into bars and sheets; also spinnings and finished articles illustrating the adaptability of these alloys, their ready machining, and good finish. Samples of zirconium compounds prepared at, and largely by a new process worked out at, the N.P.L., were shown together with articles made from silicon carbide and

also fireclay crucibles. An electric thermostat, developed at the N.P.L. by Messrs. Haughton & Hauson, was shown together with descriptive diagrams. This apparatus is used for prolonged heating of metallurgical specimens at an accurately controlled temperature. The instrument is capable of maintaining any desired temperature up to 1,000 deg. C. accurately to within 1 deg. C. for any desired length of time. The electrical measurements department contributed a model and photograph of Campbell's standard of mutual inductance calculable from the dimensions. The primary circuit of the ind ctance consists of two single-layer coils of bare wire wound in accurately measured screw cuts on a marble cylinder, the secondary being a coil of many turns and layers wound in a narrow channel on a marble ring. The two primary coils are connected in series, and the dimensions are so chosen as to make the magnetic field (due to the primary current) approximately zero over the space occupied by the channel winding. Thus the value of the mutual inductance depends chiefly upon the dimensions of the primary coils (which can be determined with high accuracy), and only slightly upon the dimensions and position of the ring coil, which cannot be found with the same precision.

The Duddell oscillograph (the actual instrument which belonged to the late Mr. W. Duddell, F.R.S., was on view), is for the purpose of finding the curve which a quickly varying current follows—for example, the wave form of an alternating current. The current passes through a loop of phosphor-bronze strip tightly stretched in a very narrow air gap between the roles of a powerful electro magnet. This loop is deflected by the current, and a minute mirror attached to the loop reflects a spot of light to a moving photographic plate, and so serves to record the motion of the loop, and thus gives a trace of the variation of the current. The electrical standards department exhibited Weston normal cells having mercury for the positive element, and an amalgam consisting preferably of 10 per cent. of cadmium and 90 per cent. of mercury for the negative element. The electrolyte is a saturated solution of cadmium sulphate in water. The depolariser consists of mercurous sulphate, and on the preparation of this the constancy and usefulness of the cell depend. Many cells prepared at the N.P.L. have remained constant in voltage within one hundred-thousandth of a volt for more than eight years. The H form is due to Lord Rayleigh (see *Phil. Trans. Roy. Soc.* 1908). This section also contains a Kelvin double bridge, the one shown was arranged for the measurement of a low resistance of 0.01 ohm. in terms of a 10, 1, and 0.1 ohm. standard (see Report of British Association, 1906). A platinum thermometry bridge for use when temperatures accurate within 0.001 deg. C. have to be measured, involving measurements of resistances within four parts in one million. The bridge that was shown enables platinum thermometers with potential leads to be used, and by means of changes in connections the resistance of the leads is eliminated from the measurements. The changes are effected by one movement of a reversing switch (see *Phil. Magazine*, October, 1912).

Henry Wiggin & Co., Ltd., Birmingham.—This firm's exhibits consisted mostly of pure nickel crucibles for laboratory use, and various compound metals. While not intended primarily for the electrical trade, the various examples of compound metals which the firm was showing, and which previously have not been produced in this country, should prove of interest to makers of cooking and heating aparatus. An investigation of these would no doubt show that advantageous use could be made of such compound metals as nickel on steel, copper on steel, nickel on copper, &c., for cooking utensils, ranges, and heaters.

Messrs. Vickers, Ltd., Westminster, S.W. 1.—Among this firm's exhibits were various types of B.L.I.C. magnetos manufactured for use on internal-combustion engines. The S.H. type magneto and coil is made for 2- to 8-cylinder engines, varying from 250 to 2,000 h.p. The system of ignition is high-tension, the magneto being a low-tension generator working through a transformer coil, the current from which is distributed by the distributor attached to the magneto. The Williams-Janney variable-speed gear that was shown by this firm has been very aptly described by a leading ordnance expert as "a means for controlling the speed transmitted from an uncontrollable source of rotary power." For example, a simple shunt-wound electric motor may be taken as "an uncontrollable source of rotary power," as it rotates at a constant speed irrespective of the load within the limits of its rating.

The variable-speed gear renders it possible to use a constant-speed direct- or alternating-current motor for driving positively mechanism at any desired speed between the maximum in one direction and the maximum in a reverse direction. In addition to being a starting, stopping, infinite speed-controlling, and reversing device, it also acts as a gradual, but positive, brake, so that the driven shaft can be reversed at high speed almost instantaneously without shock. As an example of the wonderful range in speed control, it is only necessary to quote the result of observations taken of one of these machines installed in the turret of a battleship, in which the speed of the driven shaft was varied from 485 r.p.m. down to one revolution in 10 minutes. Another valuable feature of the variable-speed gear is the fact that the maximum b.h.p. of the driving motor, or oil engine, running at a constant speed can be utilised at a wide variation of speeds of the driven shaft, as a high torque can be given off at low speeds, falling away (if desired) at higher speeds, although, of course, the same torque can be taken off at all speeds, provided the motor is sufficiently powerful to drive the machine.

This firm was also showing the well-known aircraft light alloy duralumin, with a specific gravity of 2.8, and tensile strength up to 35 tons per sq. in., and also heavy drop forged stampings, sample test pieces and a number of engineer's tools made of various alloy steels. The Vicker's hardness comparator was shown. This is a pocket instrument for ascertaining the Brinell hardness of any article in steel or other metal without the aid of a microscope, vernier, or other measuring device. It is claimed that the instrument yields trustworthy results on large and small pieces, irrespective of their foundation or support, and the test may be carried out on surfaces at any angle.

The Quain Ozone Syndicate, Ltd., Westminster, S.W. 1.—In apparatus used for the production of ozone from atmospheric air the brush discharge occurs and attacks the nitrogen, breaking much of it into nitrous compounds. Ozone as generally understood was for this reason considered dangerous to be used for therapeutic purposes. When prepared by the Quain Silica Ozoniser the ozone is free from nitrous gases, and in therapeutic doses can be inhaled with impunity. The Quain ozoniser as exhibited consists of a vacuum tube made from quartz silica, through which the energy of the ultra-violet rays passes freely, exuding an aurora about 1 mm. in radial depth, while the brush discharge that passes freely through other insulating media by this method is condensed into a non-sparking halo, permeating the ozone envelope formed round the tube, a condition heretofore not associated with ozone production.

Further, the atmospheric nitrogen becomes "ionised" in its passage through the ozoniser, and becomes a medium of conveying the important condition to the point of application with the ozone. Tests at Faraday House, London, proved that the Quain ozoniser does not produce nitrous compounds, a certificate to that effect has been given; the tests also showed a large increase of ozone produced by the silica tube compared with other methods with the same consumption of electricity. This type of Quain silica ozoniser is now in use in several British and French Red Cross hospitals. It is claimed that the apparatus has been used with success for treatment of tubercular and all diseases of the respiratory organs, also successfully applied in restoring and healing obstinate granulating wounds and sinuses which have in most cases resisted other forms of treatment.

The stand occupied by Messrs. Simplex Conduits, Ltd., Birmingham, dealt with their well-known conduits and fittings. There were several lengths of 2½-in. acetylene welded, and 1-in., ¾-in., and ½-in. butt-welded steel tube; also 2½-in.

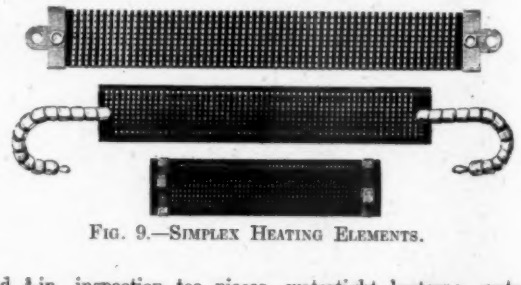


Fig. 9.—Simplex Heating Elements.

and ¾-in. inspection tee pieces, watertight lanterns, watertight switches, &c. The tubes and fittings are coated with a uniform deposit of pure zinc by electro-deposition. This method of protection against corrosion is specially designed to compete with the wasteful hot galvanising process hitherto

Fig. 10.—Electric Still.

in vogue. For a number of years the company has conducted experiments on the properties of enamel as a protective covering for conduits and fittings. As a result a large automatic electro-galvanising plant has been completed at

Birmingham, operating on the "Zenex" process. This plant, we understand, is capable of dealing with many millions of feet of conduit per annum, together with some hundreds of fittings.

There was also shown an interesting set of resistance elements, such as are used on heating and cooking apparatus (fig. 9). The various war departments have so developed the use of electric heating that the manufacture of these elements has been greatly improved and accelerated. The elements are all machine made, and are designed to comply with the most stringent Admiralty demands. One of the elements shown (fig. 9) is rather a fine specimen of workmanship, it having a resistance of 6,000 ohms in a space of 5 in. by 1¼ in. The fineness of the material, and the accuracy of the winding make this element somewhat remarkable. The electric still that was shown by the same firm is a robust and complete piece of apparatus, and has been in great demand in that and the larger sizes, for laboratory use. The growth of industrial research has greatly increased the demand for this type of apparatus, and in the near future there should be very large business in electrically-heated stills, especially as there are practically no limits to size, and many have been supplied to provide distilled water for the batteries of central stations. Similar remarks apply to the electric steriliser that was shown; the demand for this apparatus for war service has been very heavy. Electricity is so cleanly, so convenient, and so efficient for the purpose of heating water for sterilising surgical instruments that there is little doubt that it will displace any other form of heating.

WAR ITEMS.

St. Dunstan's.—The employés of Accrington Corporation electricity department have contributed £9 to St. Dunstan's Hostel for Blinded Sailors and Soldiers.

Notification of Electric Motors in Germany.—A reminder to the owners of motors of low powers of the necessity for notifying the possession to the military authorities has again been issued by the General Command of the Seventh Army Corps. It is pointed out in connection with recent re-examinations that many proprietors of motors upon which an embargo has been placed, and which are notifiable, have failed to make a return on account of ignorance of the War Office notice of June 15th, 1917. This order rendered necessary the notification of all motors of 2 H.P. and upwards which are not regularly in use in establishments engaged on war work, exceptions being made in the cases of lift motors in ordinary use and motors used for auxiliary war work. The owners of motors which come under consideration are informed that a further opportunity is now afforded them to make a return, failing which they are threatened with the legal penalties provided for non-compliance.

Exemption Applications.—At Weybridge, on September 12th, H. W. Harrington (45), electrician, was, by consent, granted six months' exemption.

At Uppingham, three months' temporary exemption was granted to G. S. Manton (Grade 3), electrician at Uppingham School.

At Tonbridge, on September 10th, six months' exemption was conceded to S. Spencer (38), electrical engineer.

At Chelmsford, the Commandant at Haskard's Auxiliary Hospital, Ingatestone, appealed for the retention of E. W. Hynds (47, Grade 1), the only man capable of running the electric light plant. Captain D. S. Smith intimated that if exemption was granted to a Grade 1 man he would have to appeal. The Commandant remarked that if the Government was stupid enough to take the only man she would have to close the hospital, and she should tell the authorities the reason. The Chairman (Mr. H. G. N. Coynbeare, J.P.): You can get another man. The Commandant replied that it would be the most difficult thing in the world to replace him. The appeal was refused, with six weeks' grace, the man to be re-graded in the meantime with a view to exemption being given if the grade is lowered.

At Enfield, exemption was claimed for A. Williams (19, Grade 1), a skilled glass-bulb blower engaged at the works of the Edison Swan Electric Co., Ltd. Mr. A. Hart pointed out that it was well known that men in that particular occupation—even men from the Guards—were being brought back from France, and replaced in this special industry. Col. Bowles said that they should ventilate their view against the disturbing and taking away from work of such men as applicant. It was notorious that glass-blowers were very badly wanted. The National Service Representative remarked that the man had the red protection card, and that he would retain until he joined the Colours, or he would have nothing to produce to show why he was out of the Army. It transpired that applicant's position came within a Royal Proclamation of last June withdrawing all certificates of exemption on occupational grounds in the case of men up to 23 years of age. Colonel Bowles expressed the hope that the National Service Representative would take some notice of that kind of case, especially as they knew that skilled glass workers were very scarce, and applicant was now doing more valuable work than he would be doing in the Army. The Tribunal decided that it had no power to entertain the application.

At Canterbury, the Corporation applied for additional exemption for W. Strand (41) and E. Roberts (40, Grade 1), stokers at the dust destructor. The electrical engineer (Mr. Blascheck) said that the work was very hard, and he doubted whether a Grade 3 man or a discharged soldier could do it. Incompetent men would not effect any economy of fuel, so important to-day. These men were able to get more steam from coal for generating electricity, and so effected saving both in coal and time. Each was granted six months' exemption.

Barnstaple Tribunal has granted temporary exemption to December 1st to F. Bickford (30, Grade 3), electrical engineer and contractor, who said that he kept in repair more than three-fourths of the electrical power plants in the borough.

The Eccles (Lancs.) Tribunal has given exemption until the end of February to the electrical engineer at Barton workhouse (46, Grade 2).

LEGAL.

War Worker's Bonus.

In the City of London Court, on Tuesday, before his Honour Judge Atherley-Jones, K.C., the Western Union Telegraph Co., 22, Great Winchester Street, E.C., sued one of its former electricians, named F. Pinkerton, Sydenham, to recover £12 18s. 10d., a month's wages in lieu of notice. Mr. Cassie Holden, plaintiffs' counsel, said that the claim was brought as a question of principle, as it involved one of national importance. The plaintiffs were carrying out work of extreme national importance, as was recognised by the Ministry of National Service. To a large extent their work dealt with Government cables and important commercial work. The claim was made to establish the right of the company to compensation for the injury done to it by the defendant leaving without notice. If a cook left nowadays one telephoned to the Labour Exchange and got a substitute at three times the wages, but there were no men to take the defendant's place, and the rest of the staff were working at very high pressure. The rule of the service was a month's notice on either side. The company did not want to be vindictive, and it had not acted harshly. Defendant entered the service in 1909. He was 31 years of age, and was originally a junior electrician, but since then had been a wireless operator on the cable steamship *Lord Kelvin*. The company recognised the greatly increased cost of living amongst their employés, and it commenced to pay war bonuses in 1915. There were three systems in all, and they overlapped. One was paid half-yearly and was deferred, and the others were monthly. But the payments were gratuitous, and were not pensionable. Plaintiffs' assistant traffic manager, Paulin, was asked on June 21st to release defendant as from July 1st, and defendant asked if he could have his bonus, although it was not technically due if he resigned before July 1st. That was objected to, but the defendant had "downed tools," and left on June 29th, much to plaintiffs' inconvenience. His salary was paid on June 29th, as well as the bonus due on July 1st. He did not come again, and plaintiffs now demanded a month's salary as defendant gave no proper notice. Defendant was now suggesting that as there was a bonus in plaintiffs' hands, payment of which was deferred until next January, they had that as compensation for him leaving without notice. But that was not so, as defendant had forfeited it. Defendant said plaintiffs agreed to him going on June 29th as he had a better situation, and there was no contract with the plaintiffs for a month's notice. He could not live on the £150 a year and bonus, and the work was very hard. Judge Atherley-Jones said that the plaintiffs had behaved with great fairness to the defendant, but Paulin had given them away as he had waived the notice. There was an obligation on the defendant to give a month's notice, but it was waived. Judgment for the defendant, without costs. It would have been very difficult for the plaintiffs to have proved the amount of their damage.

Lighting Regulations Infringed.

According to a local paper, at the Bristol Police Court, Albert Edward Maggs, of Clifton, was fined £3 for using electric light for the purpose of advertisement or display when the premises were closed for customers. Defendant did not appear. It was pointed out that this was the first prosecution taken in Bristol. Superintendent Hazell said that the object of the Order was to economise light in every respect.

E.T.U.—We are informed that at a mass meeting of station engineers of the E.T.U., a resolution was passed agreeing that for the next month new candidates be admitted to membership of the Station Engineers' Section at the nominal entrance fee, and that after that date substantial increases be made.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Wanted: A Book.

Your leaderette on the above subject in the issue of September 6th appeals to me very strongly, as on examining 300 books in our library, I cannot find any that really give lucid data of faults from the erector's point of view, and a series of books such as you suggest would be a very valuable addition to our library.

This Society has endeavoured since its foundation in March, 1914, to improve the efficiency of its members by arranging a series of technical papers each season, and I venture to suggest that the papers read and the debates which followed have been educational to both members and visitors.

Three useful papers on A.C. motors, two on D.C. motors, and many other subjects form a valuable asset for reference. Our members, however, are desirous during the ensuing season of hearing a paper on A.C. work on the lines you suggest—viz., from the erector's point of view.

I shall be glad to learn if any one of your subscribers is willing to read a paper on these lines before the Society; he would confer a benefit on our members, who comprise managers, supervisors, and foremen in the electrical trade, and such a paper might very well form part of a series of books such as you recommend.

I shall be glad to fix a suitable date and give all possible assistance to any prospective author.

Papers on electric welding, furnaces, and overhead work would be welcome.

Chas. J. Banister,
Hon. Secretary, National Association of Supervising Electricians.
50, Chipstead Street, Parsons Green, S.W.,
September 16th, 1918.

BUSINESS NOTES.

Merton's.—It was announced in the daily Press that a meeting of Messrs. Henry R. Merton & Co., Ltd., was to be held this week to consider a proposal to place the company in voluntary liquidation. It has since been reported that the meeting was held on Tuesday, but that no statement would be issued as the business was purely private and did not concern anyone but the shareholders. The *Financial Times* remarks that just over two years ago the £300,000 of shares formerly held by German firms were transferred to British subjects.

Increased Capital.—Bolckow, Vaughan & Co., Ltd. are about to increase their share capital by £1,000,000 to £5,000,000.

Liquidations.—Telephone Development Co., Ltd.—Meeting October 16th, 22-28, Broad Street Avenue, E.C. 2, to hear an account of the winding up from the liquidators, Messrs. J. E Kingsbury and A. Anns.

Brazilian Street Railway Co., Ltd.—Meeting October 17th at River Plate House, E.C., to hear an account of the winding up from the liquidator, Mr. H. Tattam.

United Vacuum Cleaner Co., Ltd.—This company is winding up voluntarily, with Mr. F. G. Fuke as liquidator.

Book Notices.—"Science Abstracts." Sections A and B Vol. XXI. Part VIII. August 31st, 1918. London: E. & F. N Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the Incorporated Municipal Electrical Association for 1918." London: Wyman & Sons, Ltd. Price 5s.

Beama Journal (Spanish edition). Vol. II. No. 3. September, 1918. London: King's House, Kingsway, W.C.

"Adelaide Municipal Tramways." Pp. 13, figs. 23. A full illustrated description of the undertaking, reprinted from the *Tramway and Railway World*. Vol. XLIII. June 13th, 1918.

"Incandescent Electric Lamp Handbook."—We have received from the British Thomson-Houston Co., Ltd., a new edition of their excellent little handbook on standard incandescent electric lamps, called "Handbook No. 1A." The widespread demand for the first lamp handbook issued has caused the company to issue this second edition, giving the latest revised Association sale rules, terms and conditions, on incandescent electric lamps. The opportunity has been taken to make this edition a more complete one in respect of the definitions and terms used in the lamp trade and lighting industry. It contains an interesting and informing article on the "Lumen," the new unit of light-rating for electric lamps, and its method of application in solving illumination problems. There is also a very complete list of photometric units, standards, and definitions, setting forth the new units of illuminating engineering, and clearly defining and describing each. These new units of illuminating engineering should be familiar to all electrical engineers and contractors, as they are likely to become definite units of the lighting industry, just as the electrical units have become known to, and used by, the electrical trade. This handbook is issued for the use of the electrical trade and electrical engineers, and copies can be obtained from the Lamp and Wiring Supplies Department, at Mazda House, 77, Upper Thames Street, London, E.C. 4.

The Banks and Industrial Restoration After the War.—At the meeting of the London City and Midland Bank called to approve the agreement for the amalgamation with the London Joint-Stock Bank, Sir Edward Holden, in the course of an exhaustive speech, which industrial students would do well to read, said that bankers were confronted with the problem of restoring the industries of the country after the war to the condition which they previously occupied. The concerns which had been converted from peace production into munition factories would have to be reconverted to their original condition. In the case of a number of those branches of industry which had continued in their pre-war occupation, such as those producing for home consumption and for export, the plant and machinery had been allowed to run down, and it would be necessary to renovate them and bring them up to date, and even to a better condition than before the war. Large sums of money would have to be found for the purchase of raw material, and large sums would also be required to improve the trade position generally. It was estimated that no less than 300 millions sterling would be required for these purposes, and credit would in some way have to be created for that amount. Large and powerful banks were indispensable for the purpose. The second reason why these amalgamations had taken place was that every effort should be made to retain London as the financial centre of the world. One of our principal competitors in the future would be Germany, and just as the Germans made great preparations for the war by increasing their armies and supplying themselves with large amounts of gold and munitions of war, so they were at the present time making their preparations for after-war trade. These preparations took the form not only of a continuation of the Darlehnskassen, but also of enlarging and strengthening their joint-stock banks by amalgamations and by the opening of new branches. As a result of their amalgamations, it was estimated that the Deutsche Bank at the present time had over 300 millions sterling of deposits, the Disconto-Gesellschaft over 200 millions, and the Dresdner over 170 millions, in addition to which it must be remembered that each of these three banks was affiliated with a number of smaller banks, over which they exercised direct control, and also a number of banks with which they were indirectly connected. For example, the Deutsche Bank was at the head of, and directly controlled, a banking group consisting of 25 banks with total deposits of about 450 millions, while the group of the Disconto-Gesellschaft was made up of 14 banks with total deposits of over 300 millions. The Dresdner Bank also had a number of affiliations. These were the three principal German banks with which they would have to compete, and to do so successfully they must meet them on a fair equality of size. By the amalgamations which had taken place in this country our banks had grown at the present time, excluding affiliations, to a magnitude measured by 300 millions of deposits in the case of this bank when this arrangement was completed, 243 millons for Lloyds Bank, 230 millions for the London County and Westminster and Parr's Bank, 212 millions for Barclays, and 176 millions for the National Provincial and Union Bank of England. The bankers had been determined, notwithstanding strenuous opposition, that it should not be alleged against them that they had not made full preparations for meeting the international trade competition which would arise after the war, and that they had not done everything in their power to retain London as the financial centre of the world.

The Pulvermacher Belt: New Zealand Prohibits Import.—The *New Zealand Gazette* of June 27th contains copy of an Order in Council of June 18th, 1918, prohibiting the importation into New Zealand of electric or galvanic apparatus known as Pulvermacher's Electrical Body Battery, Pulvermacher's Galvanic Dry Combined Bands, Pulvermacher's No. 34 Electro-galvanic Deafness Chain, and of any electric or galvanic apparatus vended by, or on account of, the Electrological Institute (J. L. Pulvermacher & Co., Ltd.), 56, Ludgate Hill, London, E.C., and of all written or printed advertising matter relating solely or principally to such apparatus.—*Board of Trade Journal.*

For Sale.—Tynemouth Corporation has for disposal one three-wire balancer booster set by Siemens Bros. Particulars are given in our advertisement pages to-day.

Falk, Stadelmann & Co., Ltd.—With reference to the letter in our "Correspondence" columns, last week, from the Cable-makers' Association, we are informed by Messrs. Falk, Stadelmann & Co., Ltd., that the paragraph reprinted from *John Bull* contains statements which are not in accordance with facts, and which should be corrected. The business was established in this country in 1881 (37 years ago), and was incorporated as a company in 1887. It has always been reputably connected with the lighting industry, and had made considerable efforts in fostering British industries, as reference to pre-war catalogues shows. The company is, and always has been, a private one, practically the whole of the capital having, from its inception, been held by British subjects. A small proportion (and that principally in preference shares, which have no control whatever in the affairs of the company) was originally held by an enemy subject. After the outbreak of the war, the company desired to extinguish this interest, and these shares were accordingly vested by the Board of Trade in the Public Trustee, and subsequently acquired by the company under the Trading with the Enemy Act (1916), so that not only is the company "All British," but also its entire capital. We understand that Messrs. Falk, Stadelmann and Co., Ltd., are willing to give any member of the trade, including Mr. L. B. Atkinson or any other members of the Cable-makers' Association, any information they may desire with regard to the constitution of their company.

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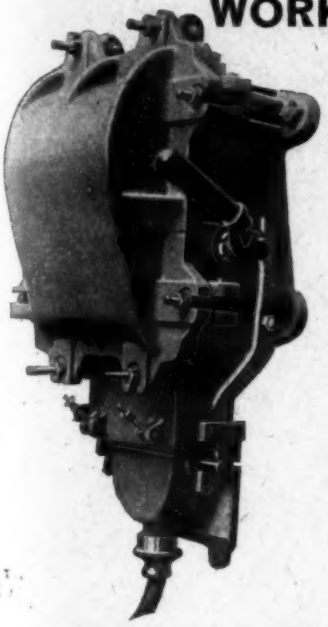

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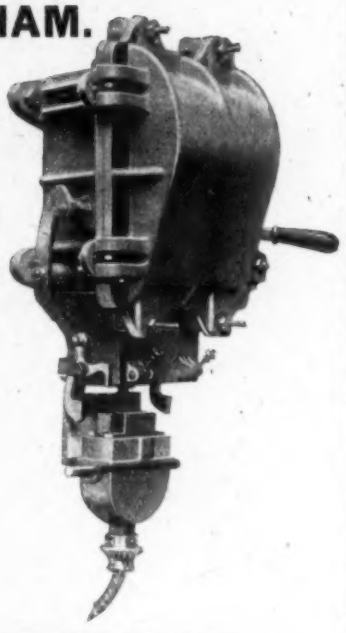

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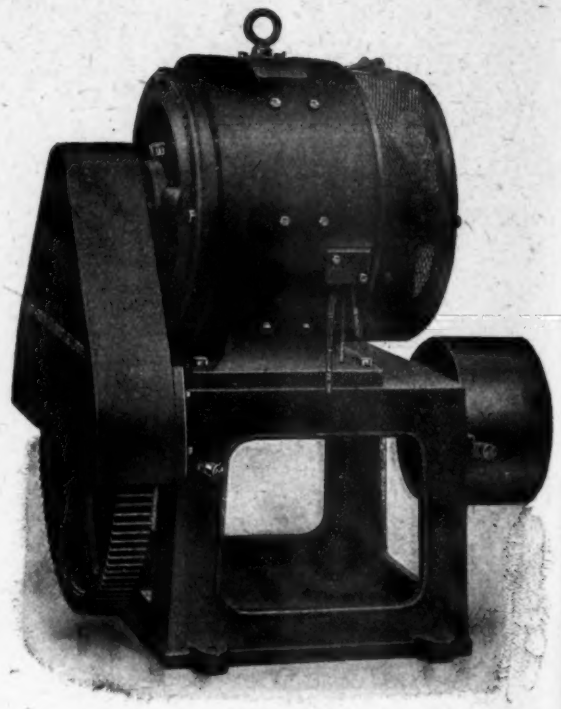

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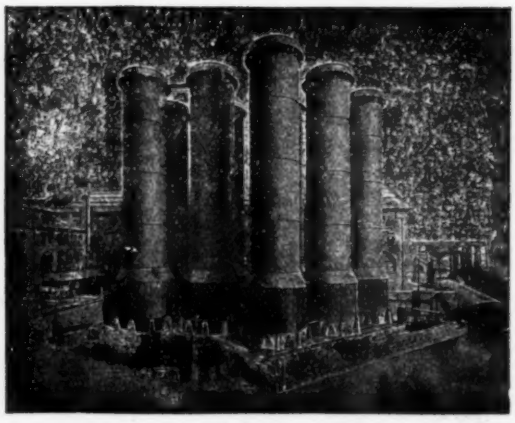

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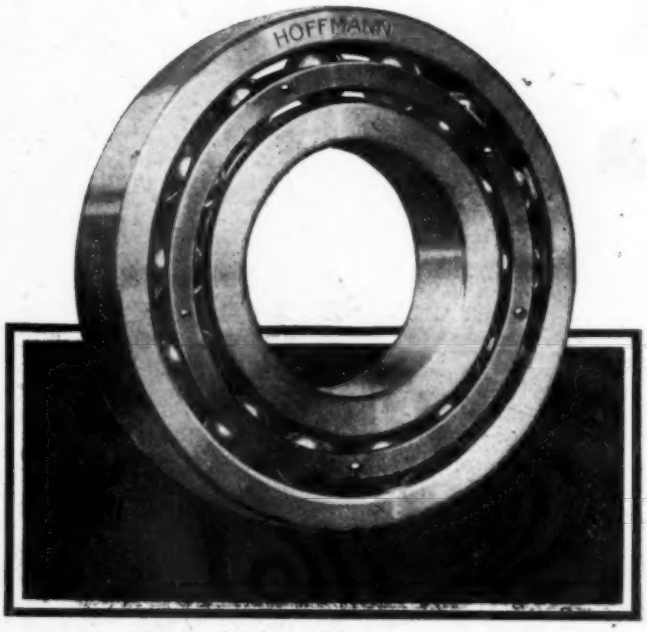

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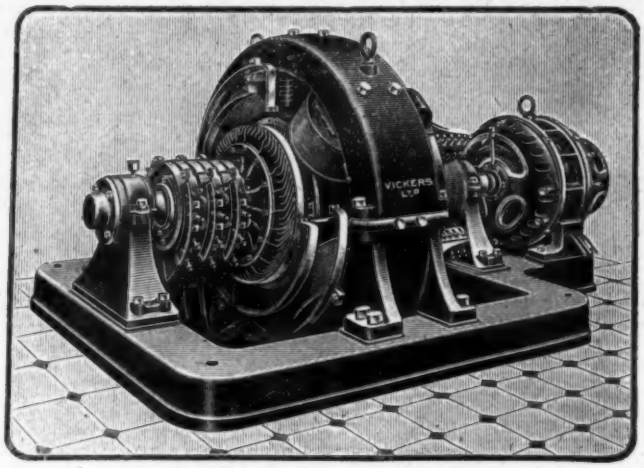

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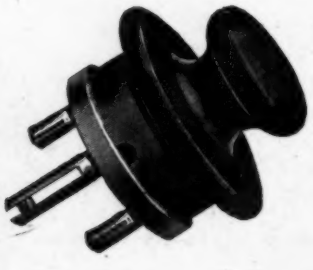

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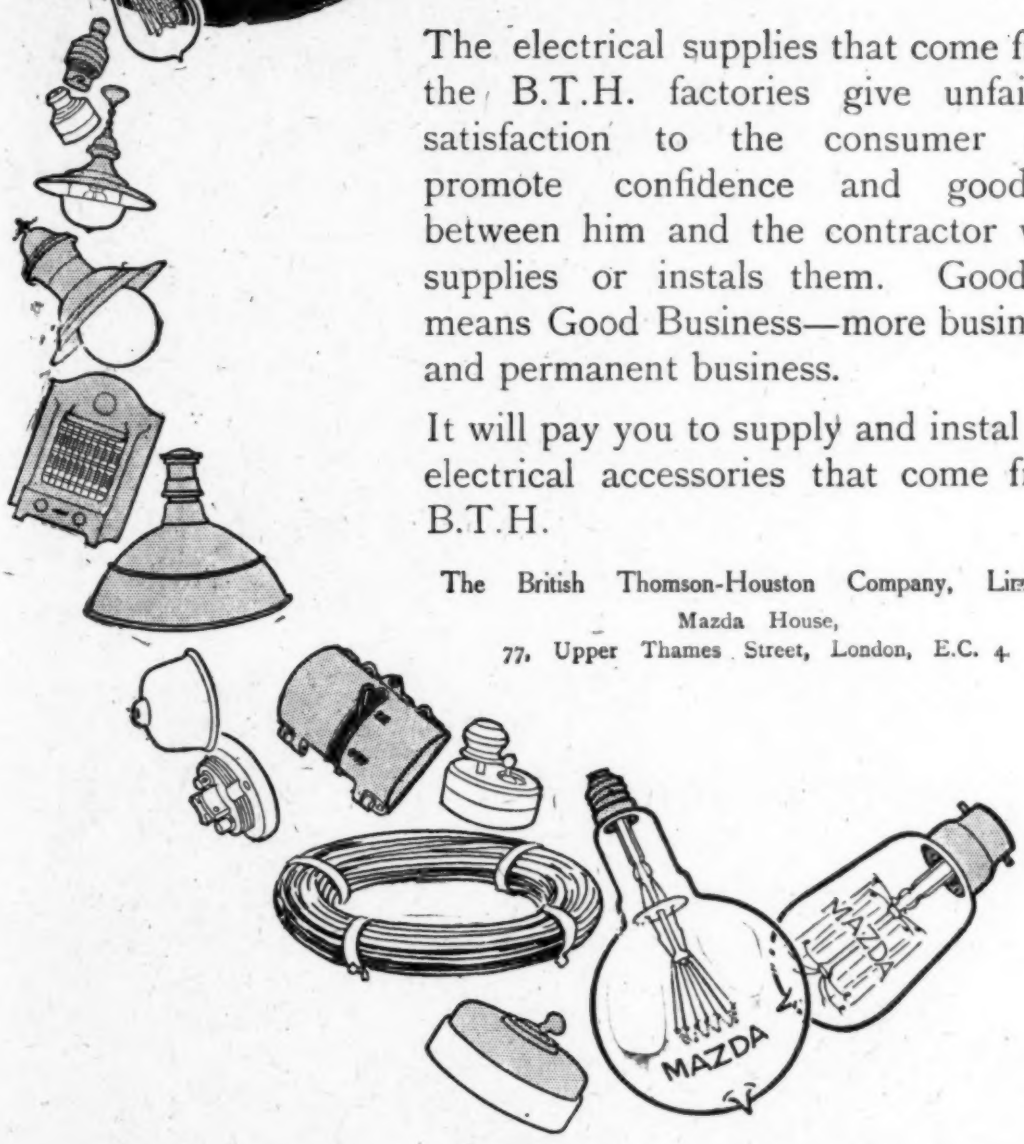

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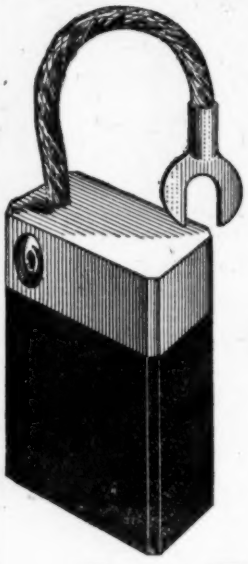

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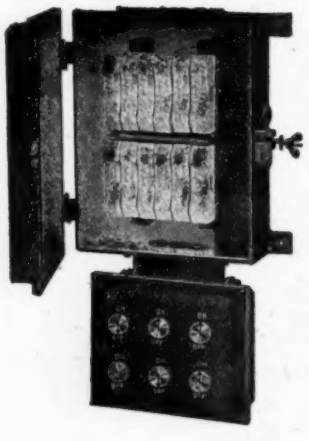

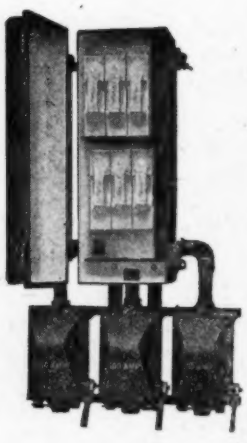

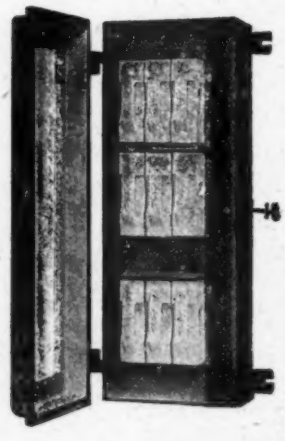

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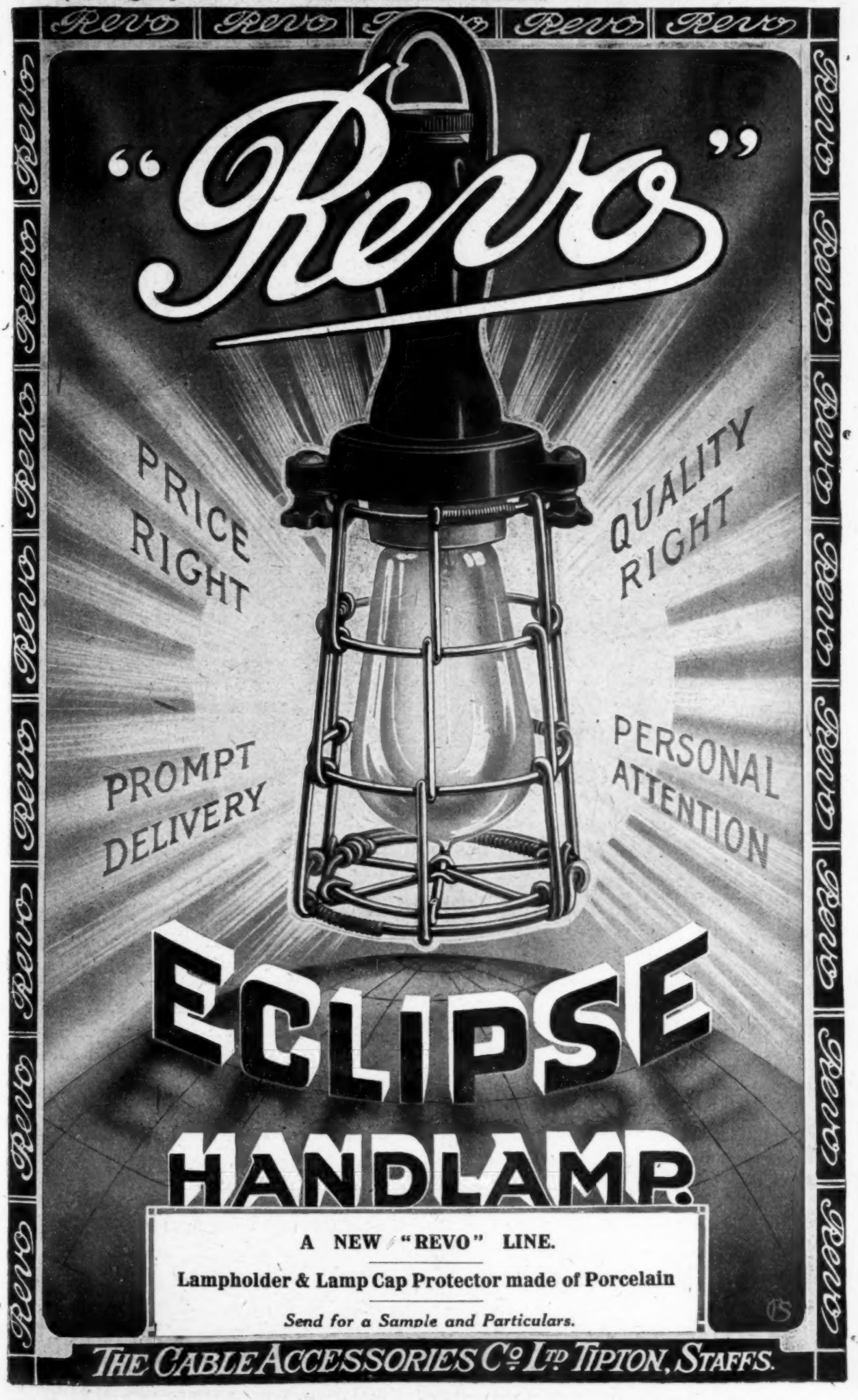
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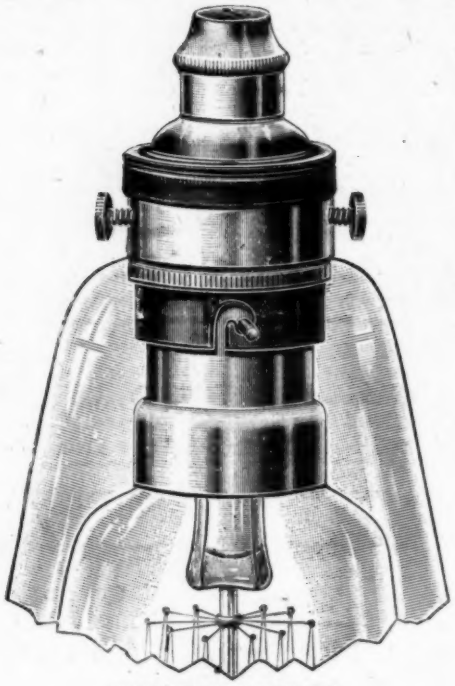

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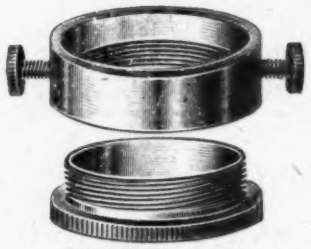

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Applications, stating age, experience and other qualifications, together with two recent testimonials, to be delivered to 2648, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

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SHIFT ENGINEER wanted for certified undertaking (municipal). Must have good electrical and mechanical experience. Wages £3 10s. to £3 15s. per week (inclusive of all bonuses) according to qualifications.

Applications, stating age, experience, when at liberty, &c., with copies of recent testimonials, to be addressed to 2645, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

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Apply with full particulars and copies of testimonials to BOROUGH ELECTRICAL ENGINEER, Electricity Works, Tunbridge Wells. 2632

ASSISTANT ENGINEER.

WANTED, in Metropolitan Power Station, Assistant Engineer: usual shift duties in extra-high-tension 3-phase station in certified undertaking. Previous 3-phase experience essential. Wages £3 1s. 6d. per week of 48 hours, usual overtime, and 12½ per cent. bonus on earnings.

2622, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

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WANTED, for large controlled establishment in the North, a first-class man, must be well-up in armature winding and all D.C. and A.C. repairs. Good opening and progressive salary to the right man. No person already employed on Government work will be engaged. Apply, stating experience, to 2628, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

BURGH OF PAISLEY.

MANAGER wanted for Paisley Corporation Electricity Works. Salary £600 per annum, free house, coal, and light.

Apply, giving full details of qualifications, to the TOWN CLERK, Paisley, not later than 9th OCTOBER. 2651

(*Continued on next page.*)

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ASSISTANT Foreman Platelayer wanted; first-class man with experience of repairs and renewals of tramway permanent way. Wage £4 per week and overtime.—Apply, stating age and experience, with copies of testimonials, to GENERAL MANAGER, Corporation Tramways, Coventry. 2616

CHARGE Engineer wanted for combined A.C. and D.C. station near Glasgow; also Switchboard Attendant.—Apply, giving full particulars of experience, age and wage expected, to 2635, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer wanted for D.C. station, gas and steam, £166 per year, plus 12½ per cent. war bonus.—Experience and testimonials to BOROUGH ELECTRICAL ENGINEER, Weymouth. 5532

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CHIEF Tester required, to take charge of transformer test, by large electrical firm in the Midlands. Permanency to suitable man. No person already on Government work will be engaged.—Apply, stating age, experience, salary required, and quoting No. A6003, to your nearest EMPLOYMENT EXCHANGE. 2534

CLERK for private Electrical Supply Works, with experience of wages, stores, allocations.—State age, experience, &c., 2646, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DESIGN Department, North of England firm, requires Assistant with knowledge of either D.C. or A.C. machine design. Applicant must be over 25 years of age and preferably of low category. No person already employed on Government work will be engaged.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5950. 2465

DISTRICT Engineer required, experienced in O.H. line work, and with good knowledge of plant on consumers' premises, &c.—Apply, stating all particulars and wage required, to SCOTTISH CENTRAL ELECTRIC POWER CO., 1, Kirk Wynd, Falkirk. 2472

DRAUGHTSMAN, several good mechanical, wanted for design of steam turbines, electrical machines, and control gear, by large firm in the Midlands. No person already on Government work will be engaged.—Apply, stating qualifications, age, salary required, and earliest date can commence, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper, and No. A5996. 2529

DRAUGHTSMAN, with experience in small electrical switchgear, distribution boards, and electrical accessories generally. Progressive position for the right man. Commencing salary £3 10s. per week. No one employed on Government work, or resident more than 10 miles away, need apply.—Write, stating age and experience, to THE SUN ELECTRICAL CO., LTD., 57/59, Neal Street, Long Acre, W.C. 2617

DRAUGHTSMEN for transformer work, required by large electrical firm in the Midlands. Previous experience not essential. Permanency to suitable men. No person on Government work will be engaged.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, quoting No. A6005. 2533

SITUATIONS VACANT.—*Continued.*

EDITORIAL Assistant wanted by publishers of technical journals and books. Knowledge of engineering and electrical workshop practice, and some literary ability required. Not liable for military service.—State age, experience and salary required, to Box 861, Sells, Ltd., 168, Fleet Street, E.C. 4. 2582

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GOOD Wireman wanted, used to maintenance, lights, telephones, &c. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply HOUSE ENGINEER, General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 2593

JUNIOR Shift Engineer wanted, D.C. station, 30s., plus war bonus 20s. and 12½%.—Apply, with full particulars, experience, age, &c., to BOROUGH ELECTRICAL ENGINEER, Electricity Works, Tottenham Lane, N. 8. 5572

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PAVIOR or Working Permanent Way Foreman required for tramway track, regular work.—Apply, stating age, experience, present position, references and wages required, to BURTON AND ASHBY LIGHT RAILWAY, Swadlincote, near Burton-on-Trent. 5559

PUBLICATION Assistant wanted for compiling technical data and engineering catalogues. Either a well-educated young lady or an ineligible man, preferably with some engineering knowledge. Must possess good knowledge of English and some initiative. No person already employed on Government work will be engaged.—Apply, stating age, previous experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. A6024. 2590

REPRESENTATIVE required for country districts with connections and experience. Suitable terms to a good man. No person resident more than 10 miles away, or already on Government work, will be engaged.—5567, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer required for hydro-electric power station in North Wales. Suitable post for discharged soldier with electrical experience.—Apply with references, stating wages required, to 2600, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer wanted for power station.—Apply, stating age and experience, to LANARKSHIRE TRAMWAYS CO., Motherwell. 2520

STOREKEEPER wanted by electrical engineers and contractors. No person resident more than 10 miles away, or already on Government work, will be engaged.—2597, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

STORES and Material Clerk, wanted for electrical engineers and contractors. Smart intelligent man only. Discharged soldier would have preference. State if any previous experience, references, and wages required. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5917. 2484

SUB-STATION Attendant wanted, London district. Experience with 3-phase supply, converter plant.—Write, stating age and wages required, to 2589, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD and Sub-station Attendant wanted for A.C. and D.C. station in West of England (Government Establishment). Good wages plus war bonus per week of seven 8-hour shifts, plus 12½%. Sunday, time and half. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, giving full particulars of training and experience, and stating military category, and mentioning No. A6013. 2531

TECHNICAL Assistant wanted by motor control gear manufacturers in London District. Must be conversant with the details of design and manufacture of all classes of motor control gear. No person on Government work, or living more than 10 miles away, engaged.—Apply, stating age, experience and wages required, to 5569, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

THE National Boiler and General Insurance Co., Ltd., St. Mary's Parsonage, Manchester, require additional Electrical Inspectors. Must be practical electrical engineers with experience of dynamo construction and repair, also electric wiring; should have theoretical knowledge and be able to take dimensions and make neat sketches of electrical appliances. Duties include the examination of dynamos, motors, wiring, various parts of electrical installations and testing of same. Applications from men eligible for military service are not invited.—Address by letter only, marked "Electrical Inspector," giving age, outline of experience, certificates and copies of testimonials, EDWARD G. HILLER, Chief Engineer. 2588

TEST-Room Assistants wanted conversant with motor control gear. No person on Government work or living more than 10 miles away engaged.—Apply, stating age, experience and wages required, to THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W. 8. 5500

TESTER required for electrical switchgear works. No person already employed on Government work will be engaged.—Reply, stating particulars of experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5938. 2489

TESTERS for transformer work required by large electrical firm in the Midlands. Permanency to suitable men. No person on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, stating age, experience, salary required, and quoting No. A6002. 2535

THE Directors of a large Engineering Firm in the West Riding of Yorkshire are open to appoint a Gentleman with high-class engineering and business experience to occupy the post of Commercial Manager, such position to carry a seat on the Directorate of the Company.—Applications will be treated in confidence and should be addressed to 5459, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Assistant Manager for electrical contractors' business, engaged in power motor supply, erection and maintenance, armature re-winding and small repairs. No person resident more than 10 miles away, or already on Government work, will be engaged.—2626, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Assistant to Works Manager in small but expanding engineering works; must have all-round experience in high-class repetition and precision work, also shop and drawing office experience, and capable of making tools; present work aircraft and munition parts. Excellent opening for progressive man with permanent after-the-war prospects; highest references essential; Ilford district. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write, stating age, experience and salary required, 2586, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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SITUATIONS VACANT.—*Continued.*

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WANTED on a Scottish Power Company (Certified Undertaking), a Shift Engineer with good mechanical and electrical training. Good wages to a man thoroughly experienced in E.H.T. 3-phase work and boiler house control.—Reply giving full particulars, with copies of references, to 1975, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Shift Engineer for small D.C. power station. Belliss engines, batteries, &c.; ineligible.—Apply, stating wage required and previous experience, MANAGER, Electricity Works, Grantham. 2527

WANTED, skilled Mechanics for London works, (controlled firm), experienced in lathe work and repairs to small machinery. No person residing more than 10 miles away, or already on Government work, will be engaged.—State age, experience and wages required, 2522, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN wanted for house wiring and general repairs.—Apply, stating wages, experience, and references, to MANAGER, Electricity Works, Felixstowe. 5519

WIREMEN, electrical, for railway repair shop near Willesden; ineligible; 73s. including bonus, 54 hours. State age and experience.—2518, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKING Engineer required for small private power and generating plant in the Midlands, to be capable of doing small fitting, repairs and adjustments. Salary £3 15s. per week.—Full particulars of past experience, age, exemption, &c., to 5574, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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APPOINTMENT FILLED.

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SITUATIONS WANTED.

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ADVERTISER, Manager to large firm of Electrical Contractors, shortly at liberty, desires similar position; thoroughly experienced in modern lighting and power schemes.—5481, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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(Continued on next page.)

SITUATIONS WANTED.—*Continued.*

ADVERTISER seeks situation, to take charge of private installation or factory plant, for the end of September. Good refs.—5512, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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(Continued on next page.)

FOR SALE.—*Continued.*

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(*Continued on next page.*)

FOR SALE.—*Continued.*

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(Continued on next page.)

FOR SALE.—*Continued.*

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FOR Sale, Traction Booster, comprising 216-H.P., 440-volt, 230 R.P.M. Motor, direct coupled to 150-KW., 500/550-volt Generator, modern machine by Brush Electrical Engineering Co., Ltd. — The Phœnix Electrical Co., 32—36, Broomielaw, Glasgow. 2541

FOR Sale, twelve 20-H.P., 500-volt, enclosed series-wound Traction or Crane Motors, by the B.T.H. Co.; £50 each.—The Phœnix Electrical Co., 32—36, Broomielaw, Glasgow. 2542

FOR Sale, two three-phase, 10-H.P., 415-volt, 50-cycle, slip-ring Motors, direct coupled to Generators, 1500 amps., 4 volts; one Dynamo, 100 volts, 100 amps.; one Cabinet Vacuum Cleaner, 240 volts; one wrought-iron Pulley, 8 ft. diam. by 20 in. 5½ in. bore.—Barnett & Soans, Electricians, Stoke-on-Trent. 5499

FOR Sale, vertical, high-pressure, three-throw Pumps, plungers 7½″ × 9″ stroke, driven by steam engine.—Williams & Sons, 37, Queen Victoria Street, London. 2650

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FOR Sale, 100-KW. Generating Set, Browett, Lindley compound engine, direct coupled to Laurence, Scott generator, 460 volts, 220 amps., 400 R.P.M., 16-KW. Generating Set, vertical enclosed engine, direct coupled to generator, 100 volts, 160 amps., 500 revs.; by Cromptons. New 50-H.P. vertical, compound, enclosed, central valve Engine, 7″ × 12″ × 5″, 500 revs., 150 lbs. pressure; suitable for direct coupling to generator.—R. H. Patterson & Co., Ltd., Forth Street Works, Newcastle-on-Tyne. 2501

FOR Sale, 500-H.P., 460-volt, 150 R.P.M., 12-pole, compound interpole Motor, by Crompton, with rope pulley, &c.—The Phœnix Electrical Co., 32—36, Broomielaw, Glasgow. 2499

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FOR SALE.—*Continued.*

6-INCH Gwynne Centrifugal Pump, direct coupled to 17-H.P., 460-volt, shunt, Westinghouse Motor, with control panel, only used short while, condition perfect.—Drummond & Co., Middlesbrough. 5452

500-KW. Steam Generating Set, comprising a Belliss triple-expansion engine, coupled to an alternator by the Electric Construction Co., Wolverhampton, 3000 volts, 50 periods, with Wheeler-Worthington independent surface condensing plant; modern plant in first-class condition, and for immediate delivery.—Harry H. Gardam & Co., Ltd., Staines. 1851

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COMPLETE Electric Plant wanted, 250 to 300 KW., direct coupled to steam engine, suitable boiler and condensing plant, 230 or 500 V., D.C. preferred.—Give full particulars, make, age, and where to be seen running, and lowest price, to S. Dixon & Son, Ltd., Swinegate, Leeds. 2596

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GENERATING Set wanted, 100 KW. or near, 110 volts, 150 lbs. steam pressure. — 2563, Electrical Review, 4, Ludgate Hill, London.

GENERATORS, one or two wanted, 60/70 volts, 400/500 amps. D.C. Fullest particulars, lowest terms.—Tilney, Olympia, Newport. 5457

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OLD Electric Lamps that have had wire-drawn tungsten filaments in them previously wanted, glass parts intact. Agent's price 2d. each.—847, Harrow Road, London, N.W. 10. 4932

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(Continued on next page.)

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WANTED, a few 200-volt, 50-period, single-phase Motors, slip-ring type, with starting gear; any size between 5 and 25 H.P.—2492, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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WANTED, Generating Set, 500 volts, 50 periods, 3-phase, 100 to 200-KW., Belliss or Browett engine preferred, but would consider other good make.—2494, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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WANTED, Motor-Generator, 400 volts, one-phase, or 200 volts, two-phase, to about 70 volts, 80 amps.; also one 440 volts, D.C., ditto.—R. F. WINDER, Cross Belgrave Street, Leeds. 2360

WANTED, Motors, 1 H.P., 200 or 410 v., D.C.; 1 H.P., 210 v., 85 cycle, single-phase.—J. L. SMITH, 45, Queen's Road, Peckham, S.E. 15. 5562

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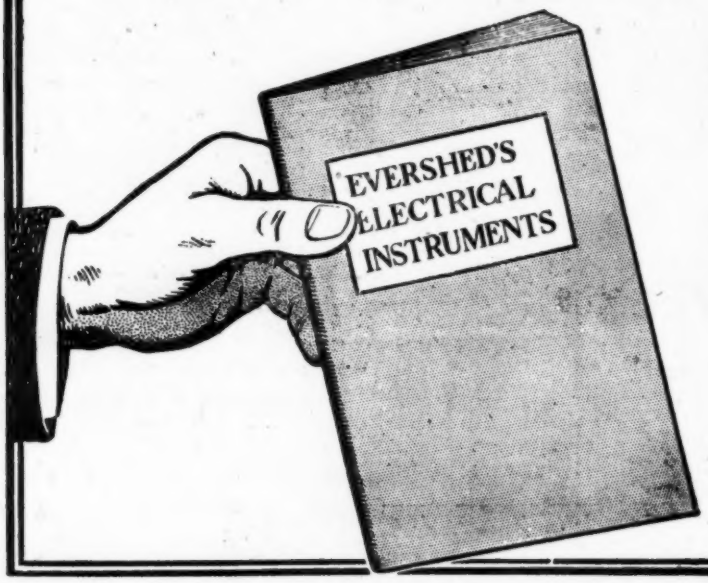

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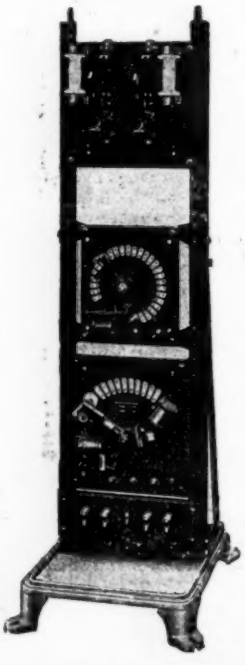

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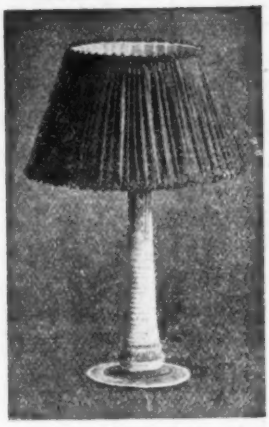

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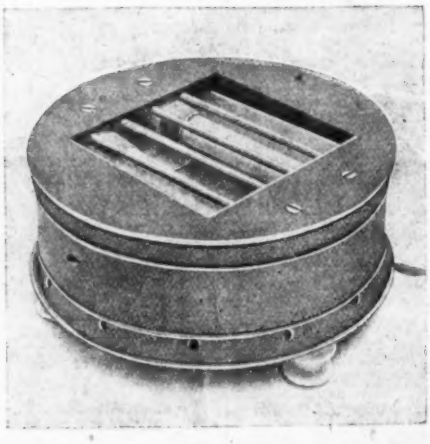

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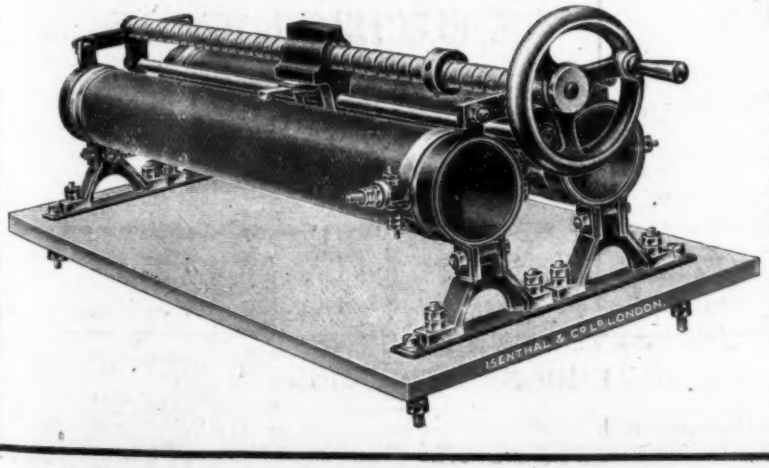

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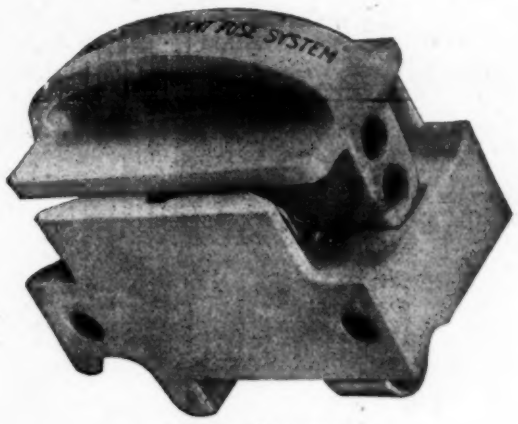

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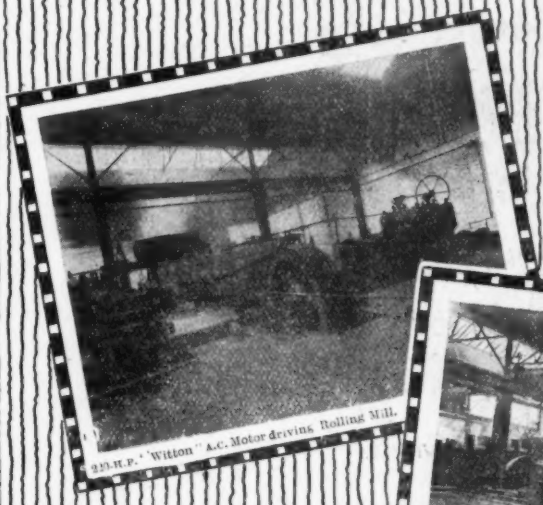

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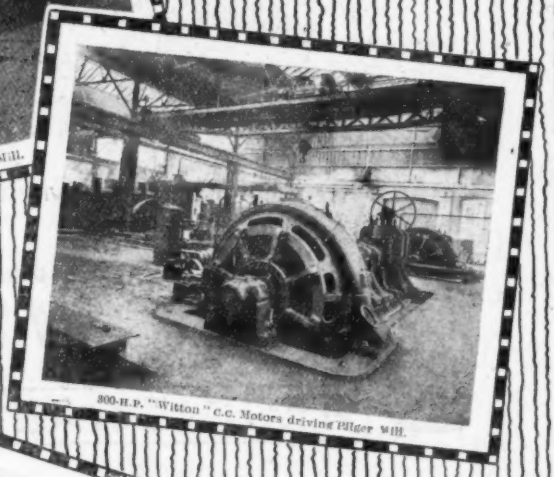

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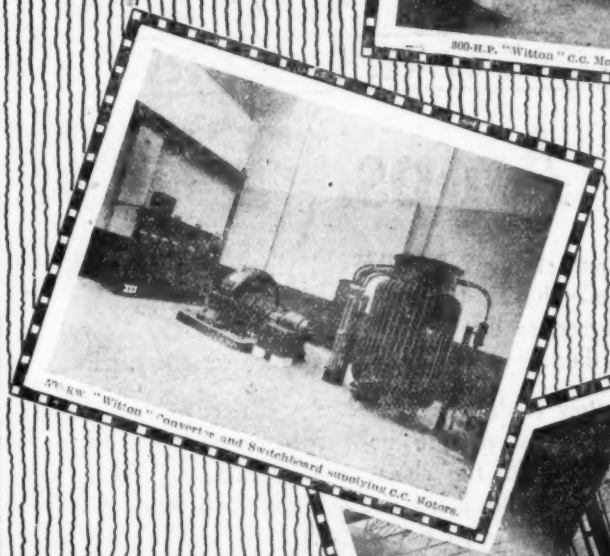

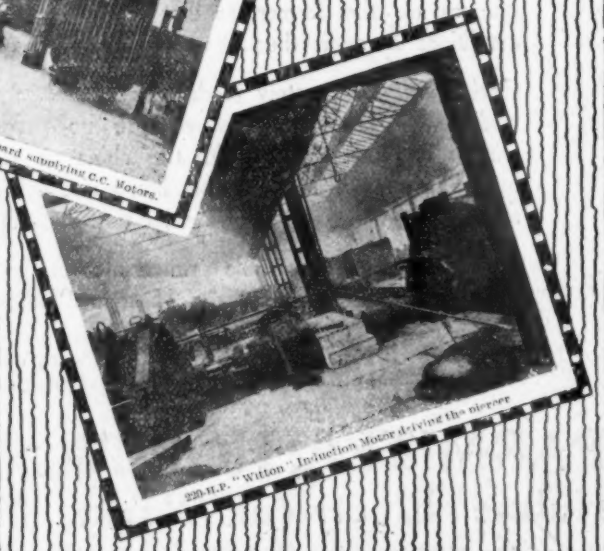

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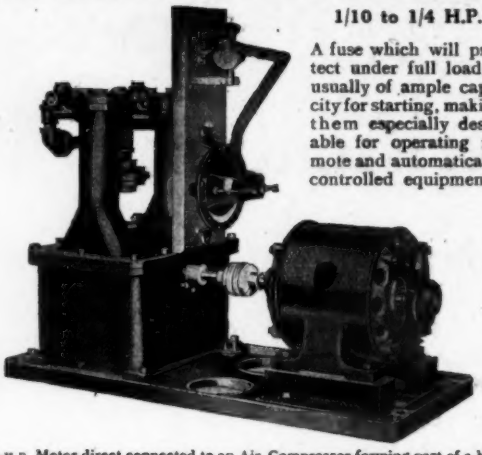

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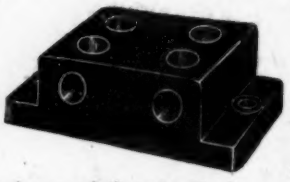

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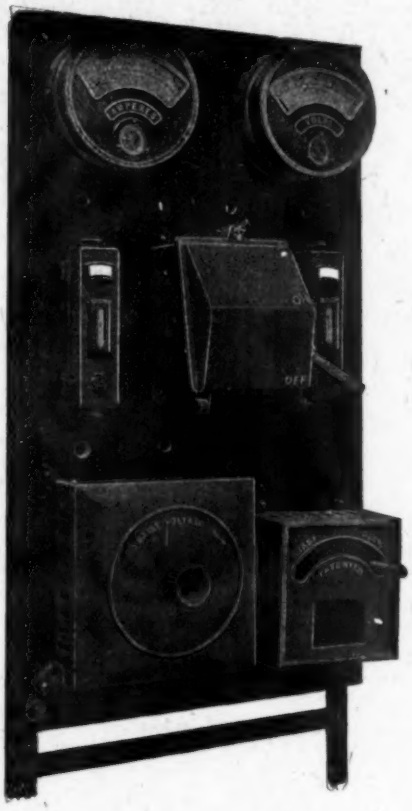

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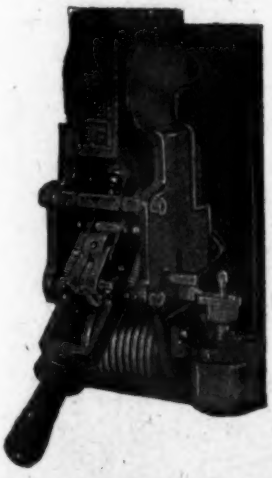

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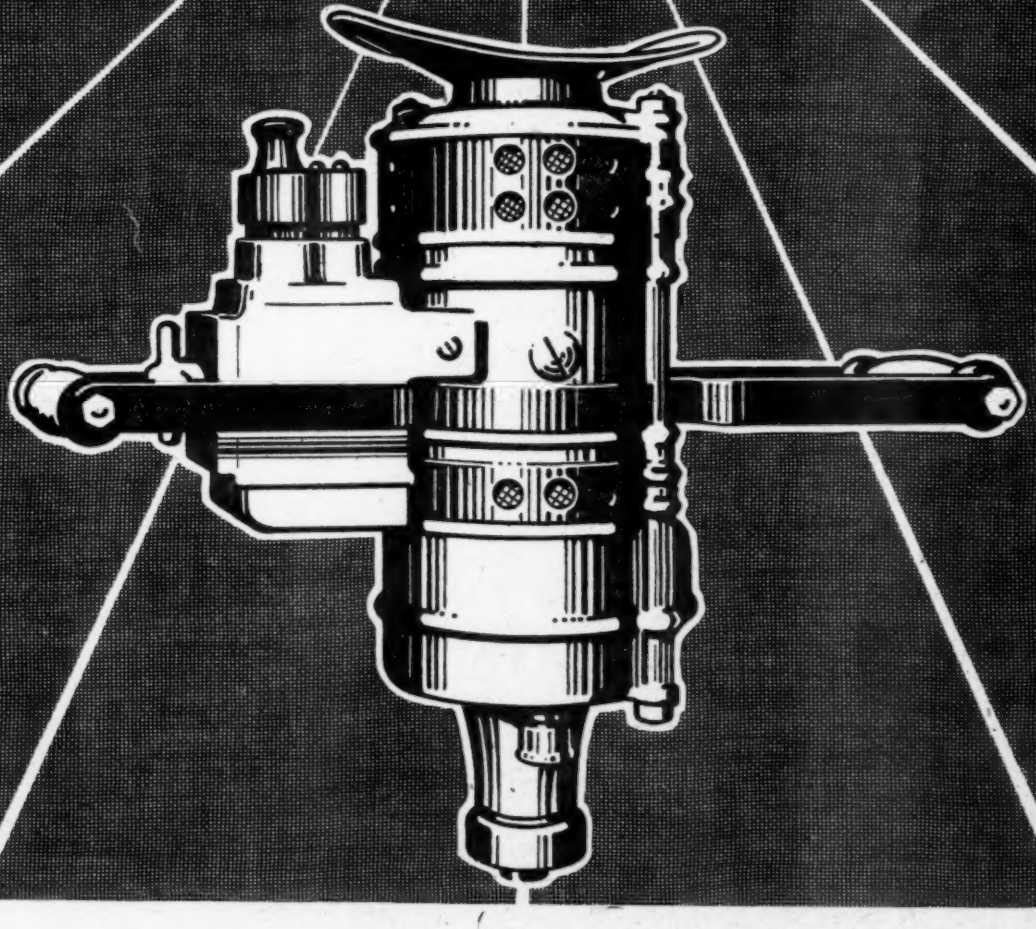
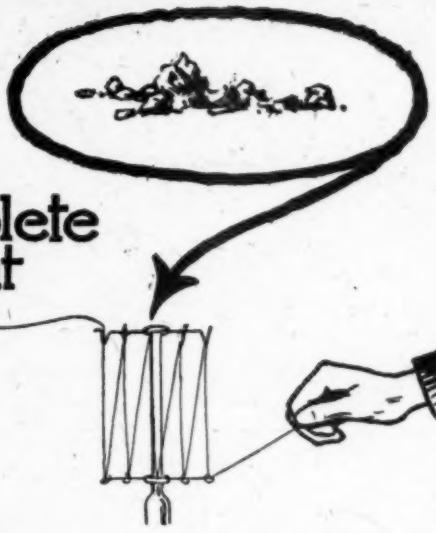
Whose Electric Tools have been classed first at the International competition held by the French Admiralty, in 1914, before the War.



From the Tungsten Ore—



to the complete wire filament

Process by process the work is carried out by British labour in our London Works. We do not buy the Tungsten Powder or the Tungsten Rod.

We begin with the Ore, refine and reduce it, work it into rod, swage it down, and finally draw down into the finest filaments.

We are Tungsten and Molybdenum experts.

See that your lamps are made with

"Pladuram" Wire

which is the only sure guarantee of a British product from start to finish.

Duram Ltd

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Simplex

INDUSTRIAL LIGHTING FITTINGS

For Shop, Factory, or Outside Lighting, Simplex Industrial Fittings are unequalled. If carefully installed better lighting at less cost can be effected than by any other method.

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10 & 11, Denmark Street, Bristol.
96, Whitechapel, Liverpool.
6, White Horse Street, Leeds.
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The Little Lamps with the Big Name

The streets will be darker than ever this winter. There will be a big demand for flash'amps.
It will pay you to stock MAZDA Flashlight Bulbs. Show them in your window.
The name MAZDA will sell them.

IMMEDIATE DELIVERIES FROM
THE BRITISH THOMSON-HOUSTON CO., LTD.
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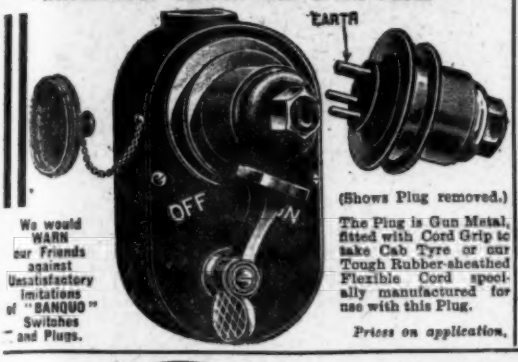
THE "BANQUO" SYSTEM (Registered).

AS SUPPLIED IN LARGE NUMBERS TO ARSENALS, DOCKYARDS, EXPLOSIVES FACTORIES, CHEMICAL WORKS, FACTORIES, &c.

"BANQUO" SAFETY INTERLOCKING COMBINED WATERPROOF SWITCH AND 3-PIN PLUG.



(Shows Plug removed.)

We would WARN our Friends against Unsatisfactory Imitations of "BANQUO" Switches and Plugs.

The Plug is Gun Metal, fitted with Cord Grip to take Cab Tyre or our Tough Rubber-sheathed Flexible Cord specially manufactured for use with this Plug.

Prices on application.

"BANQUO" IRON-CLAD DISTRIBUTION SWITCH SYSTEM. Supplied Single or Double-Pole.

This System will commend itself to engineers as an improvement on the practice of mounting a number of switches inside the same box as the fuseboard and in place of straggling single units. The switches are mounted on one iron base, this being usually fitted in proximity to the distributing fuse-box. The switches are foolproof, and saving is effected in cost and labour. The words "ON" and "OFF" are cast on the lid, and the switch handle is of cast gun-metal, giving a substantial yet neat appearance. The boxes can be drilled and screwed to requirements, and there is ample space inside cases for safety and ease in wiring.

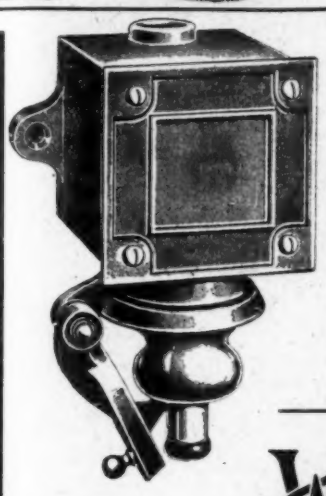
WE CAN SUPPLY "BANQUO" SWITCHES WITH LOOSE OR REMOVABLE KEYS, 1/4 per way extra.

"BANQUO" TWO-WAY SWITCH.

NUMBER OF SINGLE POLE 5-AMP. SWITCHES.

1	2	3	4	5	6	7	8	9	10	11	12
5/0	9/4	14/-	18/8	23/4	28/-	32/8	37/4	42/-	46/8	51/4	56/-

Prices for Double-Pole and 10-amp. Switches on application.



Heavy Current Ironclad Plugs and Socket

Improved Special Export Type.

Heavy cast-iron Plug, with Socket, largely used in Collieries, Tram Sheds, and exposed positions. This improved pattern is much superior to other plugs, and can be recommended for rough usage with the utmost confidence.

No. A8/400
15 amps., 2-pin type, **16/-** ea.

No. A8/410
15 amps., 2-pin type, and Earthing Plug, **18/8** ea.

We can supply the above with special exposed earthing terminals, to new regulation requirements. Price **20** per cent. extra.

DOCK AND FACTORY HEAVY CURRENT WATERTIGHT PLUGS.

As supplied to the War Office, and important Government, Railway and Dock Contracts.

Made in 2 or 3-pin plug type from 10 to 600 amps. capacity.

These plugs are substantially well-made. They are fitted with stout earthing connection, which make connection first and break connection last. A protecting cap is fitted with a chain which prevents the current-carrying parts from exposure when plug is out.

Ward & Goldstone

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Telegrams: "Multum," Manchester. Telephones: 7083-4-5-6 Central.

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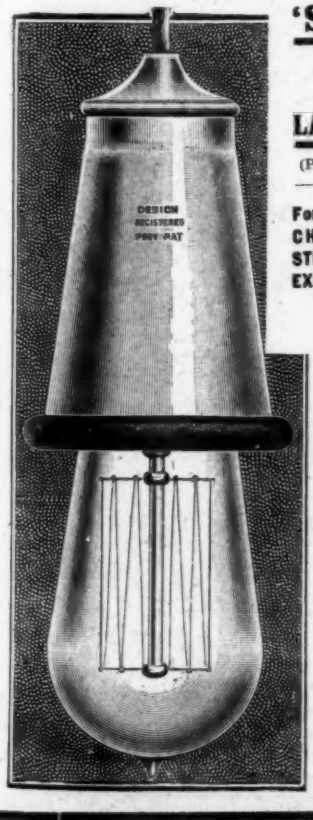
GLASGOW Office: 50, Wellington Street.



'SAMPSON' ACID AND WATERPROOF LAMPHOLDER.

(P. Patent. Reg. Design.)

For Use in DYE WORKS, CHEMICAL WORKS, STEAM SHEDS, and EXPOSED or CORROSIVE POSITIONS.

Specially designed to meet the demand for an acid and damp-resisting holder.

The shell is of strong vitreous acid-resisting porcelain fitted with an acid-proof rubber shield which effectively protects the lamp cap and interior lampholder from dampness and corrosion.

The top of the porcelain holder fits on loosely after wiring, enabling the top chamber of the interior to be filled with a sealing compound. The cap is then dropped back into position, when the sealing compound is plastic.

The features of this holder are ease in wiring, reliability, and effectiveness. The holder is arranged to take Standard Tough Rubber jacketted flexible Cord. (Prices and samples on application.)

List No. 101. Price **4/-** ea.

Subject to trade discounts.

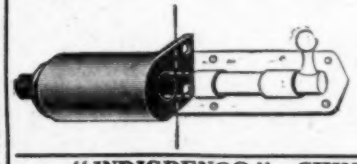
The New Order *re* Shiplighting

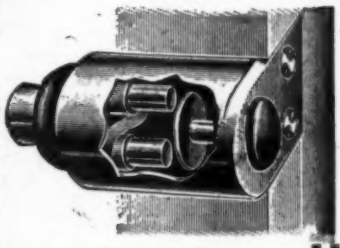
requires that all Deckhouses, Lavatories, Cabins, etc., are to be fitted with

DOOR SWITCHES

so that when a person is leaving these rooms the light is automatically switched off before the door is opened, thus preventing any beam of light showing and disclosing the whereabouts of the ship. This Switch is Mechanically and Electrically the best type made for the purpose; the Metal Barrel is a heavy casting turned and polished.

The current-carrying parts are mounted on China. The Switch is actuated by fixing a bolt on the door, and the Switch on the frame of the door, in line with each other. When the door is closed and bolted, the bolt presses down the plunger of the Switch. Attached to the plunger is an insulated metal disc which engages the spring buffers, thus switching on the light. When the bolt is withdrawn the light is automatically turned off.





LIST No. 44/675.

Price **5/4** each, subject.

Suitable for right or left-hand doors.

No cutting away of door posts.

Suitable **Door Bolts** for above switches. Brass Barrel with iron shoot.

Price **2/-** each.

The Most Solidly Constructed Bolt Switch.

"INDISPENSO" CHINA CONNECTORS.

(Registered No. 382530.) British Made.

Substantial Metal Parts with good threads. No metal projecting parts.

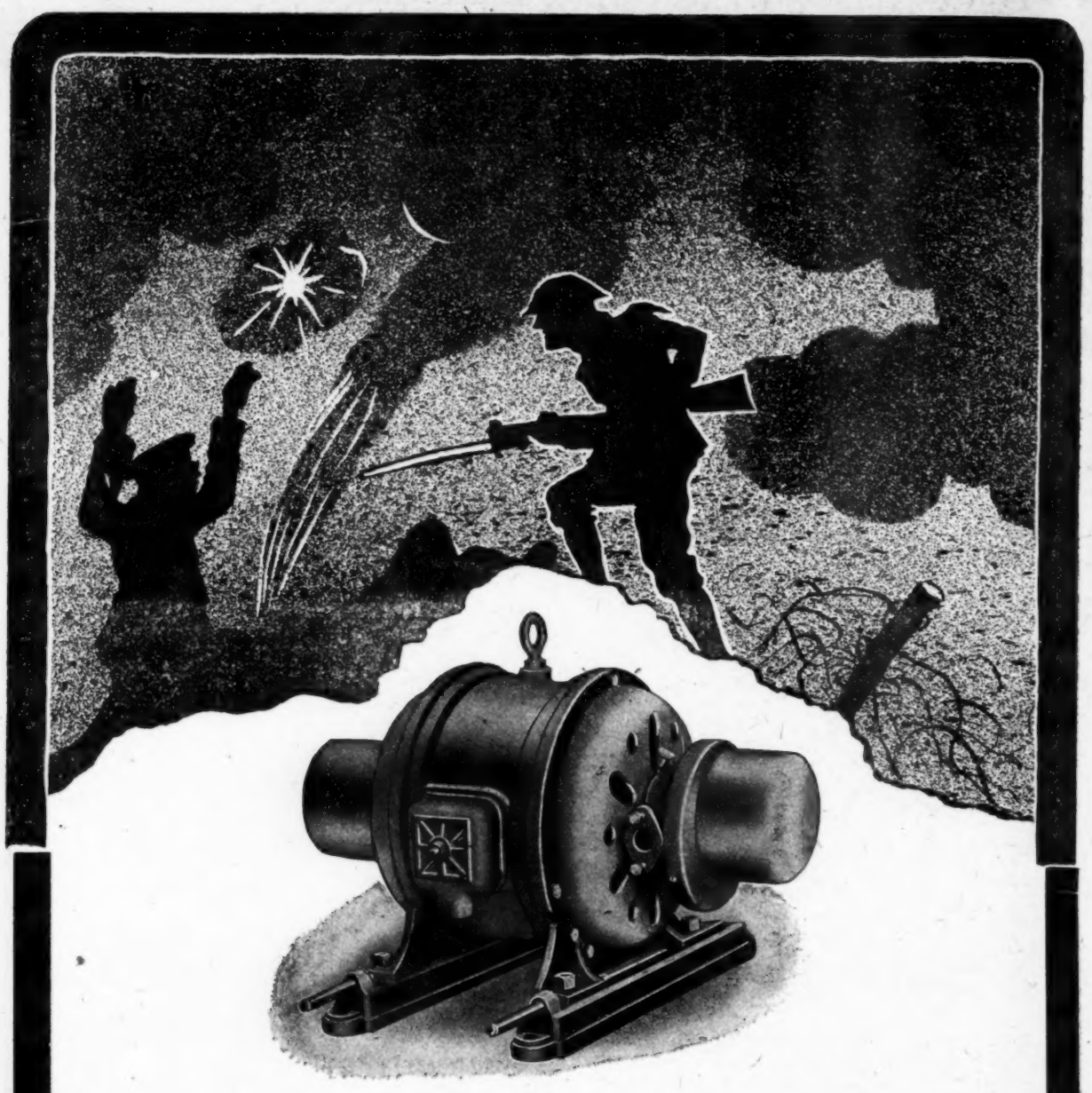
Ensures good joints. Made in eight different sizes.

One, Two and Three-way, small size, to take up to 7/20's Cable (2·74 m/m).

One, Two and Three-way, medium size, to take up to 7/17's Cable (4·27 m/m).

One and Two-way, to take 19/17's (7·11 m/m).

Prices and Particulars on request.



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E. BROOK, Ltd.,
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LEEDS.

Please address your inquiries for Screws of all kinds to

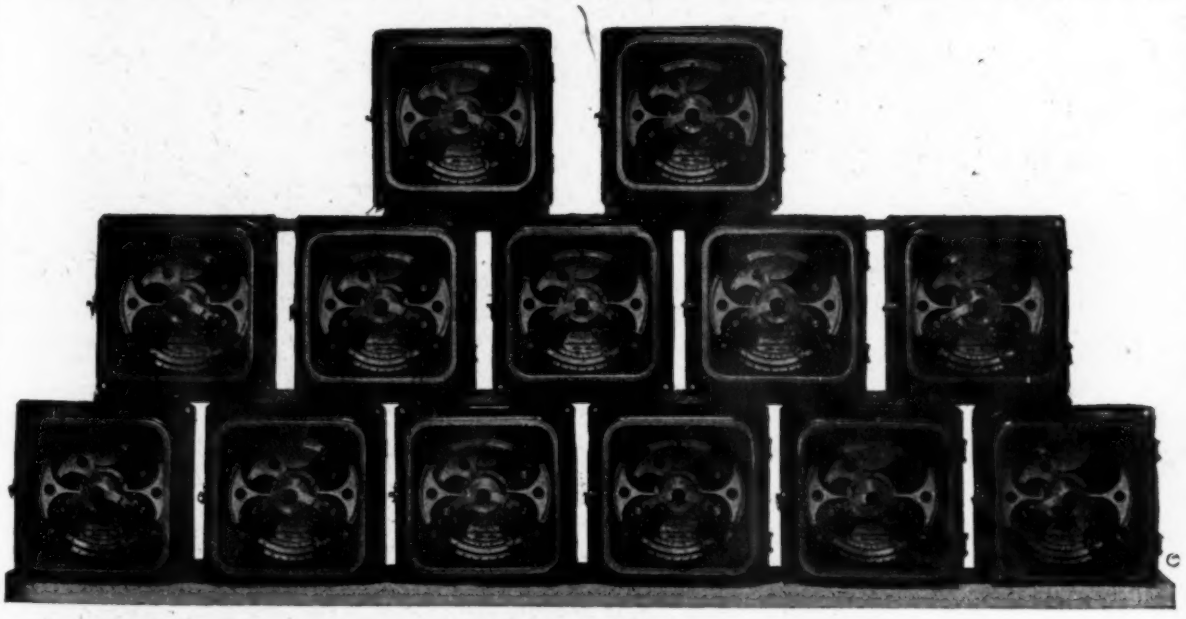
D. GILSON & CO.

LIMITED,

BILLET WORKS,

GILSON LONDON E. 17 GILSON LONDON

AUTOMATIC PRESSURE REGULATORS.



Part of an order for Automatic Pressure Regulator Equipments for the Victorian State Railways.

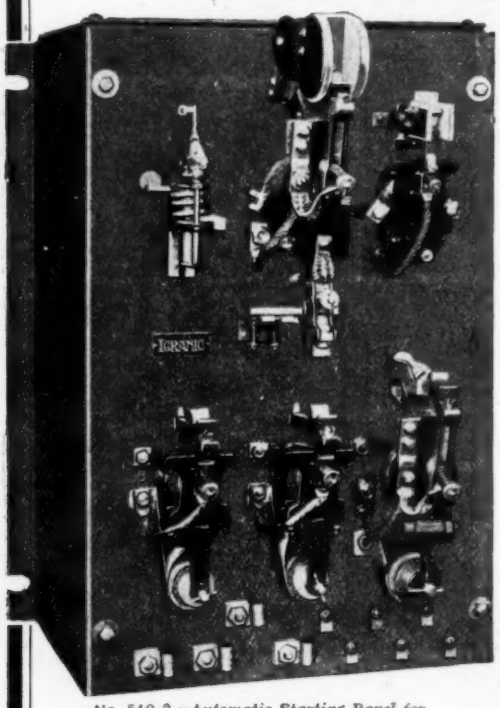
BROWN, BOVERI & CO., LIMITED, 9, OLD QUEEN ST., WESTMINSTER, S.W. 1

CONTROL
IGRANIC
ELECTRIC
DEVICES

SPEED-SETTING CONTROLLERS

for electrically-driven

MACHINE TOOLS.



No. 510-3.—*Automatic Starting Panel for Speed-setting Controller, Types 6320 & 6325.*

MACHINE Tools such as Milling Machines, Boring Mills, etc., which require only infrequent changes in speed are most efficiently and speedily controlled by "IGRANIC" AUTOMATIC CONTROLLERS, TYPES 6320 (non-reversing) and 6325 (reversing).

Starting and Stopping is performed at the machine by push-buttons. The speed can be predetermined by hand regulator before the machine is started up or altered by the same means while running.

SPECIAL FEATURES OF DESIGN

1.—The Accelerating Switches used for the armature circuit are our Patent Magnetic Lockout Type, which are governed by the load conditions, and prevent too rapid short-circuiting of the starting resistance. The use of these switches renders interlocking contacts and circuits, series relays, protecting resistances and protecting resistance switches unnecessary, thus making the controller exceedingly simple, both electrically and mechanically.

2.—The vibrating Relay is a device which automatically short circuits the field regulating resistance whenever the motor current exceeds the predetermined value, which value can be easily adjusted as desired. It ensures that the motor always has full field when starting, and after starting it automatically and gradually accelerates the motor to the speed for which the field rheostat has been set. If, while running, an overload causes the motor current to exceed the predetermined value, the vibrating relay will automatically vary the regulating resistance so as to reduce the motor speed until the overload has ceased. This feature protects the motor from injury through momentary overloads caused by hard spots in the metal, or extra heavy cuts, and generally obviates the necessity for an overload relay.

No. 510-2.—*Drum Type Starting, Stopping, and Reversing Master Switch for Speed-setting Controller.*

No. 350-3.—*Speed Regulator. Hand-operated.*

IGRANIC ELECTRIC Co LTD

147, Queen Victoria St., LONDON.

30, Cross Street. MANCHESTER.

Works: **BEDFORD.**

50, Wellington Street, GLASGOW.

Printed by WILLIAM CATE, LTD., 147-150, Saffron Hill, E.C. 1, and Published by the Proprietors, H. ALABASTER, GATEHOUSE & KEMPE, 4, Ludgate Hill, London, E.C. 4.

South African Trade Report.—The report of H.M. Trade Commissioner in South Africa for 1917 was published yesterday.

Trade Announcement.—Mr. Leslie Miller announces that owing to increased business he has removed to larger manufacturing premises at 70, Sanderstead Road, South Croydon, Surrey. Telephone: No. 2117 Croydon.

Catalogue.—The General Electric Co., Ltd., Queen Victoria Street, London, E.C. 4.—Catalogue of 28 pp. (X Section, 1918 edition), relating to high-tension switchgear. Illustrations, descriptive notes, tabulated details and prices, and dimension drawings, appear relating to oil-break switches and switch panels, truck type switchgear, tension limiters and lightning arresters, limiting resistances, choking coils, isolating links, underground switch-boxes, relays, static leakage detectors, &c.

Competition in China After the War.—In the course of a lengthy speech to the shareholders of the Pekin Syndicate, Ltd., in London, on Monday, the chairman, Mr. T. A. Barson, made the following interesting remarks on the question of after-the-war competition in China:—

"There will be keener competition than ever after the war. Japan, whose industrial progress has been particularly favoured by the European war, will naturally fight hard to retain her position. France, with her go-ahead policy, is making, and will continue to make, big strides in industrial enterprises. America—particularly during the war—has had glaring proof of the demands of China for machinery, and the chances of obtaining raw materials from her. German influence has been checked somewhat, but she will endeavour to renew her efforts more vigorously than ever after peace is declared. It is to be hoped that our Government is fully awake to the possibilities for British trade over there, and will do everything possible to help to secure for Great Britain a share of the business of this wonderful country. I am not trying to pose as a European expert on China. I oft-times doubt whether there is one in existence, but I have had some experience of the people and customs, and I assure you that to a European both are full of surprises. There is a lot of work still to be done, but the possibilities and prospects are great. . . . Trust on the part of the Chinese has taken the place of suspicion, and they are now as anxious to accept our help in the development of their country as we are pleased to offer it."

Lantern Slides.—The Liverpool Electrical Engineering Co., 18, Vauxhall Road, Liverpool, desires the loan of lantern slides connected with any branch of the electrical industry for use at the evening classes for the apprentices and junior members of the firm.

Messrs. E. Bennis & Co., Ltd., 28, Victoria Street, S.W. 1, have a large number of lantern slides dealing with development and present practice in connection with automatic stokers, coal elevators, conveyors, &c., for loan for lecture purposes.

Patents and Alien Enemies.—Application has been made to the Board of Trade by Messrs. William Suckling & Sons, Birmingham, to avoid or suspend Patent No. 26,436/07 granted to Bosch for sparking plugs.

LIGHTING AND POWER NOTES.

Aberdeen.—Threatened Strike.—At a mass meeting of Corporation employés in connection with the strike of certain sections of municipal workers, the employés of the gas and electricity departments notified the Corporation that, unless an agreement was arrived at within a reasonable time, they would also strike. The gas workers' strike would be in sympathy with the other departments, but the workers in the electricity department demand an increase of 3s. 9d. per week to bring their bonus on a level with the £1 per week granted to the gas workers in March last. The Council has intimated its willingness to grant this increase as from the date of the men's application, August 17th.

Aberystwyth.—Hydro-electric Scheme.—The T.C. has again referred the question of a hydro-electric scheme to the Public Works Committee for a report. Dr. Harries informed the Council that there would not be the slightest difficulty in getting 1,000 or 2,000 H.P. from the weir, without storage.

Ammanford.—Electricity Charges.—The owner of the electricity works, Mr. W. Herbert, has given notice to the Council that, unless the price paid to him for energy is advanced by 25 per cent. for private lighting, and by 50 per cent. for public lighting and power, he wishes to terminate the agreement. The Council has sought legal opinion as to Mr. Herbert's powers to increase meter rents by 500 per cent.

Aston-under-Lyne.—National Electricity Supply.—The T.C. has adopted a resolution of the E.S. Committee protesting against the embodiment in legislation of the recommendations of the terms of purchase by the State of generating stations and transmission lines, as recommended by the Electric Power Supply Committee (B. of T.), on the ground that the terms would penalise prudently-managed undertakings and place a premium on undertakings which have failed to create depreciation and reserve funds (Clause 56 B), and also against the recommendation to confiscate sinking funds and then to require municipal authorities to discharge their loan obligations (Clause 56 F). In the event of such a Bill being introduced, the Parliamentary Committee of the Council is to be instructed to rigorously oppose it.

Barnsley.—Electricity Supply.—The T.C. has requested the acting borough electrical engineer to prepare a special report on the cost of supplies of electricity to new consumers, and increased supplies to existing ones.

Bradford.—Mains Extensions.—The Electricity Committee has authorised the extension of the mains to Bowling Iron Works, at a cost of £204, and at New Cross Street, at a cost of £420, including transformer equipment.

Bury St. Edmunds.—Year's Working.—In his report for the past year, the borough electrical engineer states that the stand-by margin of plant is insufficient, and that after the war the works will probably be unable to meet the demand. He recommends that the mains be extended to the Northgate district without delay; with the necessary switchgear this is estimated to cost £2,500. The price at present paid for coal is 31s. per ton, against 26s. last year and 15s. in 1914. The income for the year amounted to £6,544, an increase of £1,669 over the previous year, and the expenditure to £4,604, against £3,828. Capital charges absorbed £2,208, leaving a debit balance of £268, compared with £1,037 in the previous year. Units sold numbered 361,197, against 291,507.

Coatbridge.—Valuation.—At the Coatbridge Valuation Court the Assessor agreed to a reduction of £202 on the Coatbridge and Airdrie E.S. Co.'s valuation.

Colchester.—Price Increase.—The E.S. Committee proposes to increase the charges for electricity by a further 10 per cent.

The Director of Army Contracts has informed the Council that the proposal to increase the price of electricity supplied by contract cannot be sanctioned; the Council is seeking the advice of the L.G.B. on the matter.

Continental.—Spain.—A concession has been granted for the utilisation of the water power of the river Cubillas, at Ablote (Province of Granada), for the generation of electricity.

Sweden.—The Mysajo-Oviken Kraft Aktieholag is the name of a new company formed to establish an electricity undertaking at Kovra.

Darwen.—Year's Working.—There was a loss of £1,868 on the past year's working of the T.C. electricity undertaking.

Denby and Cumberworth.—Prov. Order.—The U.D.C. has decided not to oppose the application of the Electrical Distribution of Yorkshire, Ltd., for a prov. order to supply electricity within its area.

Derry.—Price Increase.—The Corporation has increased the charges for electricity by a further 15 per cent., making 40 per cent. over pre-war prices.

Dover.—Wages.—A demand of the Kent Division of the Workers' Union, that the war bonus of employés at the electricity works be increased to £1 per week, plus 12½ per cent., has been granted by the Corporation.

Dublin.—Proposed Curtailment of Supply.—Speaking at the Dublin Rotary Club, Mr. Lorcan Sherlock, T.C., who has been so long associated with the Corporation electricity supply undertaking, stated that he proposed submitting to the Corporation various suggestions for the curtailment of lighting facilities, private and public, including the taking of power supply during daylight hours where possible, and the cancellation of unnecessary trains and tramcars, while he would ask for a reduction of office fires and police inspection to discover coal hoarding. The Corporation, said Mr. Sherlock, did not wish to cut down any user of electricity by a single unit. It had fought a successful campaign to prevent the electricity undertaking passing into the hands of private individuals or companies, and it wanted to make the concern a paying one. He wanted support to enable the Corporation to secure increased supplies of coal—if necessary, from those who had stocks in large quantity—so that it might keep employed the industries controlled by the 1,300 motor concerns who were its customers. By cutting down the supply of electricity for lighting, the Corporation would be depriving itself of the customers who were the best payers—those who paid the largest price per unit. This policy was bound to result in a large deficit on the undertaking, and the charges for power would have to be increased, so that the loss might be reduced and no further burden be thrown on the general ratepayers. He added that whatever regulations operated in regard to electricity must also apply to gas. Mr. Kevin Kenny expressed the view that the Corporation's proposed arrangement with the promoters of the scheme for harnessing the Liffey at Lucan for electricity purposes might relieve the situation; but Mr. Sherlock said the Lucan scheme could not be put into operation this year, even if it were adopted.

The Pembroke (Dublin) Urban Council has decided on a reduction of the public electric lighting.

Dundalk.—Price Increase.—The U.D.C. has applied to the B. of T. for power to increase the maximum charges for electricity as follows:—Up to 20 units per quarter, from 13s. 4d. to 15s.; over 20, from 8d. per unit to 9d.

Folkestone.—Price Increase.—The Electricity Supply Co. has informed the T.C. that from the commencement of the September quarter the price of energy to the Corporation will be increased by ¼d. per unit, plus 15 per cent., in lieu of the previous advance of ¼d. per unit, plus 15 per cent.

Halifax.—EARLY CLOSING.—A mass meeting of shopkeepers, recently addressed by Mr. W. M. Rogerson, borough electrical engineer, decided, with a view to economising lighting, that all shops should close at 7 p.m. on Fridays, 8 p.m. on Saturdays, and 6 p.m. on other week days.

Harrogate.—PUBLIC LIGHTING.—The T.C. has decided that all Corporation lights shall be extinguished throughout the winter before 10.30 p.m.; street lamps are to be lighted an hour later than last winter.

Hove.—YEAR'S WORKING.—The past year's working of the Hove and Aldrington electricity undertakings, owned by the Hove T.C., resulted in a net profit of £1,380, against £745 in the previous year. Owing to the war there was great difficulty in effecting repairs during the year; four of the engines had to be entirely dismantled and re-erected, and as it was impossible to obtain new parts, old ones were used. Compared with the previous year, the cost of fuel increased by 6s. 9d. per ton.

Keighley.—YEAR'S WORKING.—For the first time since 1911 the annual accounts of the Corporation Electricity Department show a loss, amounting to £591; in the previous year there was a profit of £223. A great deal of trouble was experienced during the year with all the turbo-generators, and for weeks together the continuity of supply depended upon one set. The trouble with the 5,000-KW. set has been located, and the old plant is now running better than at any time since its installation. The total capacity of the plant is now 10,000 KW. The gross revenue for the year was £33,560, compared with £28,622, whilst the expenditure amounted to £24,725, against £19,592. Capital charges amounted to £9,423, against £8,806. Units sold totalled 8,510,566, against 8,011,991, including private lighting, 489,472, against 250,216; public lighting, 26,450, against 22,300; power, 7,620,831, against 7,337,926; and traction, 373,543, against 401,549. The number of consumers increased from 710 to 747, and the maximum demand from 3,256 KW. to 3,703. The total works cost per unit was '69d., against '58d., and the over-all cost was '95d., against '84d.; the average price obtained increased from '85d. per unit to '92d.

Limavady.—PUBLIC LIGHTING.—The Town Hall, which has been without illumination since the closing down of the local gasworks last April, has now a complete electric light installation, and the U.D.C. is proceeding with the lighting of the streets with electricity.

Londonderry.—PRICE INCREASE.—The Corporation has increased the price of electricity by 15 per cent., making an advance of 40 per cent. since 1914.

Linthwaite.—PROPOSED E.L.—The U.D.C. has appointed a Committee to consider the relative cost of gas and electric lighting.

Penistone.—MAINS EXTENSIONS.—The U.D.C. has given permission to the Yorkshire E.P. Co. to extend its mains to Stocksbridge, by means of overhead wires.

South Africa.—JOHANNESBURG.—The Finance Committee has recommended an increase of 10 per cent. on the electricity accounts, which will return £20,000 per annum.

CAPE TOWN.—A recent temporary failure in the supply of electricity in the suburban area was due to a rat causing a fault on the 11,000-volt switchgear at the central power station.

Sheffield.—YEAR'S WORKING.—The total revenue of the Corporation E.S. department for the year ended March 25th last, amounted to £687,580, against £505,561 in the previous year, and the expenditure, including income-tax, to £416,883, against £292,046. Of the balance, interest absorbed £64,247, against £55,755, and sinking fund £71,107, against £62,265, leaving a credit balance of £133,372, against £95,494. These figures include the following amounts relating to the Installation and Motor Department:—Revenue, £47,923; expenditure, £44,393; capital charges, £1,223; profit, £2,306. Units sold were—for lighting, 8,371,532, against 7,311,245; public lighting, 8,861, against 2,767; power, 138,745,140, against 94,899,504; heating, 1,763,214, against 1,443,659; and traction, 23,562,260, against 22,819,683; total, 172,451,007, against 126,476,858. The number of consumers increased from 7,556 to 7,722, and the maximum demand from 46,493 K.V.A. to 57,338. The capacity of the station is now 68,225 KW. The renewals fund stands at £338,644. The cost per unit sold was '7d., against '68d., and included fuel and removal of ashes, '34d.; other generating expenses, '09d.; distribution, '08d.; and capital charges, '19d. The average prices obtained were:—Lighting and heating, 2·32d.; power, '79d.; total average price, '88d.

PRICE INCREASE.—From the September meter readings, electricity supplied by the Corporation at 2d. per unit and under is to be subject to an increase of 45 per cent., in lieu of the present increase of 33⅓ per cent.

Southport.—CONTROL OF ELECTRICITY DEPARTMENT.—At a meeting of the T.C., on the 10th inst., a motion was put forward for the control of the gas and electricity departments to be under one committee, in order to avoid competition.

WAGES.—A letter from the E.P.E.A., asking for the 12½ per cent. bonus to be granted to the technical staff, was adjourned for further information.

Thirsk.—PUBLIC LIGHTING.—The Parish Council has agreed to accept the tender of the Electric Lighting Co. to light 29 street lamps at £2 3s. 3d. per lamp per annum, an increase of 8s. 3d. over the previous year.

United States.—FUEL ECONOMY.—The New York *Times* states that the Fuel Administration announces that records show that a saving of over 60,000 KW.-hours (equal to 100 tons of coal) was made on the first of the "lightless nights" in the borough of Manhattan. The figures, it is stated, indicate a coal economy through the "lightless nights" of 40,000 tons a year in Manhattan alone. The national saving is estimated at "more than 1,000,000 tons of coal a year."

Walsall.—YEAR'S WORKING.—The year ending March 31st last resulted in a loss of £3,999 on the Corporation electricity department, compared with a deficiency of £8,988 in the previous year.

Walton-on-Thames.—PRICE INCREASE.—The Council has decided to protest to the L.G.B. against the proposal of the Urban Electric Supply Co. to advance the price for electricity from 7d. to 8d. per unit.

Warrington.—EXTENSION.—The Corporation has received the consent of the Warrington R.D.C. to supply electricity to the works of W. Mortimer & Co., which are in the area of the R.D.C.

Wishaw.—YEAR'S WORKING.—The T.C. electricity undertaking showed a profit of £1,047 for the past year, against a loss of £242 in the preceding year.

Winchester.—PRICE INCREASE.—The T.C. has increased the price of electricity for all purposes by a further 15 per cent. from the end of the September quarter, making a total increase of 40 per cent. over pre-war rates.

Wolverhampton.—YEAR'S WORKING.—For the past year the revenue of the Corporation electricity department amounted to £121,172, against £76,744 in the previous year. The gross profit was £17,242, but after meeting capital charges (interest, £9,290; repayment of capital, £15,493; and income-tax, £1,583) there was a debit balance of £9,124. The reserve fund increased from £14,944 to £19,565. The cost of fuel increased from £28,930 to £67,589, and wages increased by £10,018. The number of units sold for power purposes advanced from 13,222,504 to 28,144,937.

TRAMWAY AND RAILWAY NOTES.

Blackburn.—YEAR'S WORKING.—The annual report states that there was a profit of £6,971 on the Corporation tramway undertaking for the past year.

Continental.—ITALY.—The *Pall Mall Gazette* states that a group of English steel manufacturers has offered to provide the rolling stock and material for a projected tramway to connect Rome and Ostria.

Dublin.—GOODS TRAFFIC ON TRAMWAYS.—At a meeting of the Irish Sub-Committee appointed to inquire into matters relating to inland transport, Mr. Dockrell, of the Dublin Industrial Development Association, expressed the opinion that better use should be made of the tramways, which should be linked up with the docks, and distribute goods through the city. The tramways already carried and delivered parcels very efficiently, and also carried gravel from Howth to the outlying suburbs. Motor lorries would do very well for parcels but tramways would be much better for loads of from 10 to 20 tons. The chairman of the Port and Docks Board said that, with so many concerns generating electricity in Dublin, it was impossible to get cheap power; energy could be obtained at half the price from one central station. He also suggested that a tunnel should be constructed under the Liffey.

Leeds.—PROPOSED EXTENSIONS.—The Tramway Committee is considering several schemes for tramway extensions in connection with the proposed development of the garden suburbs. The Committee last week inspected the Middleton housing scheme, the connection of which with the existing system will involve the building of 4 miles of new track. Schemes for extensions to Hawkerworth Wood, Roundhay, and other places are also before the Committee. It is probable that a high-speed system, up to 30 miles an hour, will be adopted.

Liverpool.—Referring to the overcrowding of the tramways, it was stated at a meeting of the Tramways Committee that, provided materials and labour could be obtained, 100 cars at present unused could be put into service.

London.—WAGES.—The offer of the Railways Executive of 4s. per week advance to adult employés, and 2s. per week to those under 18, has been rejected by the N.U.R.

Otley.—Fares.—After repeated protests against the increased fares on the Guiseley-Otley-Burnley railless-traction section of the Leeds Corporation tramways, the Otley U.D.C. has referred the matter to the B. of T.

Thornaby.—Proposed Purchase.—The Tramways Committee has recommended the T.C. to join with Stockton in the purchase of the Stockton and Thornaby tramway undertaking, subject to the division of the cost being based upon the population.

United States.—Tramway Rates.—Executives representing practically every important tramway system in the U.S.A. met in New York in August, says the *Railway News*, to consider the action of the National War Labour Board in increasing by an average of some 40 per cent. the wages paid to tramway employés in connection with the necessity for increased fares. A member of the Association's War Board presented a statement which indicated that unless relief was afforded in some way, the increase in wages awarded would bring the tramways to the verge of bankruptcy. The statistics showed that in 1916 the net income of the 1,260 tramways in the United States amounted to about $70,000,000, with a gross income of $672,000,000. For 1917 the net income had decreased to $35,000,000, and statistics of the 154 represented companies showed a decrease in net income for the first three months of 1918 of 94 per cent. The awards of the National War Labour Board, if applied generally throughout the country, would mean an increase of $100,000,000 a year in the pay-rolls of the companies—sufficient to wipe out the entire net income and to absorb over 50 per cent. of the money now paid for fixed charges. In this connection a referendum vote was cast in the city of Buffalo. The tramway company had recently raised the wages of its employés by 25 per cent., with a further advance promised, and the City Council had passed an ordinance authorising an increase of fares from 5 to 6 cents. Without such added revenues, it was said, the company would have to be placed in the hands of a receiver. But under the new Buffalo charter the proposed alteration in the terms of the tramway franchise had to be submitted to the voters, who rejected it.

TELEGRAPH AND TELEPHONE NOTES.

Telegraph Operators' Wages.—The National Joint Committee of Postal Telegraph Workers in the British Isles held a Conference at Matlock on Friday and Saturday, last week. Twenty delegates, representing 120,000 workers, attended. The chief business of the Conference was the question whether the workers should put forward a new claim for better wages for all postal telegraph employés in the country. It was decided to do this, in co-operation with the Association representing the Civil Services. The principle of equal payment for men and women was adopted.

U.S.A.-Japan.—It is reported in the *Evening News* that a new high-power wireless system is to be established between Japan and the United States. The present Japanese high-power wireless station communicates direct with Hawaii. The proposed station will work with another on the Pacific coast, and this will constitute one of the longest direct wireless services in the world. Its cost will be £80,000.

CONTRACTS OPEN AND CLOSED.

OPEN.

Manchester.—September 23rd. B. of G. Six months' supply of electric lamps. J. MacDonald, Clerk to Guardians, All Saints.

Spain.—The municipal authorities of Puente Genil (Province of Cordoba) have lately invited tenders for the concession for the electric lighting of the town during a period of ten years.

Stockton-on-Tees.—September 20th. Corporation Gas and Electricity Committees. Stores for six months. See "Official Notices" September 13th.

CLOSED.

Barnsley.—T.C. :—

Callender's Cable Co., Ltd.—E.H.T. main, £2,672.
Babcock & Wilcox, Ltd.—Draught fan for boiler, £294.
Stewarts & Lloyds, Ltd.—Steel steam pipes, £110.

Bradford.—Electricity Committee :—

Goodall, Clayton & Co., Ltd., Leeds.—Two sets of steel work for reinforcing foundations at Valley Road generating station, for Nos. 5 and 6 turbo-generators.
John Fenton & Sons, Ltd., Batley.—Purchase of the disused No. 15 slow-speed set at Valley Road.

Glasgow.—Tramways Committee. Recommended tenders :

Brake blocks.—Carron Co.
Trolley wire.—Thomas Bolton & Sons, Ltd.
Lead-covered cable.—B. I. & Helsby Cables, Ltd.
Pitch.—Robinson & Hunter.

FORTHCOMING EVENTS.

Industrial Reconstruction Council.—Tuesday, September 24th. At 6 p.m. At the Institute of Journalists, 2 & 4, Tudor Street, E.C. Conference on "Trade Boards," to be opened by Mr. J. J. Mallon.

Municipal Tramways Association (Inc.).—Thursday, September 26th. At 11 a.m. At the Town Hall, Leicester. Presidential address by Alderman S. Flint, and paper on "Some Considerations on the Post-war Position of Electric Power Supply," by Mr. E. Hatton. Annual general meeting.
Friday, September 27th. At 11 a.m. Annual general meeting resumed.

Junior Institution of Engineers.—Friday, September 27th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecture on "The Most Important Piece of Machinery in the World," by Mr. P. Marshall.

NOTES.

Coal and Iron in Ireland.—At a meeting of the Irish Sub-Committee of the Parliamentary Committee on Irish Transport, held in Dublin last week, Mr. William Tatlow, B.E., representing the Arigna Coal Mining Co., Co. Roscommon, said that his company was engaged in exploiting the minerals in the Arigna Valley, to the west of Lough Allen. Coal, iron ore, fireclay, and flagstones were the minerals they produced. Coal and flagstones, for the moment, were the chief productions. Iron ore and fireclay could not be worked owing to want of transport. A railway was being constructed to connect the coal mines with the Cavan and Leitrim Railway. The iron ore and fireclay could only be developed through the waterways of the Shannon. The output of coal had increased from 82 to 120 tons per day, and there would be a further increase when the connecting railway got into operation. The largest quantity of coal produced in one year was 12,000 tons. There were about 18,000,000 to 20,000,000 tons of coal in the locality.

Foreign Trade.—The August Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

	August, 1918.	*Inc. or dec.*	8 *months*, 1918. *Inc. or dec.*
Imports.			
Electrical goods ...	66,924	— 30,394	— 207,731
Machinery	924,100	+106,190	+ 1,883,046
Exports.			
Electrical goods ...	166,031	— 91,141	— 749,490
Machinery	1,364,988	—279,363	— 2,716,787

An Australian Magneto.—The Australian mail brings the news that Mr. A. T. Kwajel, of Melbourne, has devised an improved form of ignition magneto. While following Bosch practice, the machine is stated to be notable in the reduction of the number of moving parts, one brush replacing six on the Bosch ; other features are a new type of armature and the ability of the machine to give a strong spark at low speeds.

Disintegration of Copper-Aluminium Alloy.—A case of disintegration of a copper-aluminium alloy was recently described by Messrs. R. Seligman and P. Williams before the Institute of Metals. A large consignment of scrap aluminium wire netting was recently received for re-melting. The bulk of this wire was in a normal state, but interspersed with it were a number of wire frames which showed unusual signs of disintegration. The surface of the wire seemed to have broken up into a number of loosely adhering grains up to 10 mm. in length uniformly inclined to the axis of the wire. On removing the loose grains a solid core of wire was disclosed, which was found by analysis to contain :—Silicon, 0·33 per cent. ; iron, 0·30 per cent. ; copper, 2·65 per cent. It is considered that this may be taken to have been the composition of the original wire. A sample of the other wire which had not suffered disintegration gave the following figures, which are believed to be substantially representative :—Silicon, 0·24 per cent. ; iron, 0·22 per cent. ; copper, 0·07 per cent. The wire had been used for a number of years solely for supporting thin slabs of gelatine, which are said to be free from all chemicals, with the exception of small quantities of hydrogen peroxide, and both the disintegrated and the unchanged wires had been used for the same purpose, and for about the same time. The disintegrated wire had apparently been very severely overdrawn, the core breaking readily when bent at right angles. On annealing, the ductility of the core was restored, showing that its brittleness was not due to disintegration. The unchanged wire was soft. The grains were coated with a grey substance, presumably alumina, but when washed with concentrated nitric acid the coating was largely removed, and the metallic surface of the grains was exposed. Under magnification of 30 diameters it was evident that the grains were composite, and on warming them with dilute nitric acid they were further resolved into what were in all probability the ultimate grains, the largest of which was about 0·1 mm. long. In the present instance two causes have probably contributed to the disintegration—namely, the excessive work put upon the wire in the first instance, and the copper with which it was, no doubt unintentionally, alloyed. By analysis it was established that there was a very definite difference between the copper content of the grains which had been warmed with dilute nitric acid and of the unchanged core, but that the grains were far from being pure aluminium. The copper content of the grains was found to be 2·49 per cent., and that of the core of unaltered wire 2·65 per cent.

Annealing Cold-Rolled Aluminium Sheet.—Mr. R. J. Anderson's paper, read before the Institute of Metals last week, answers the inquiry, may not cold-rolled aluminium sheet be softened by relatively short annealing exposures at the same or somewhat more elevated temperatures. It is shown that the lighter gauges of cold-rolled aluminium sheet can be softened by such an abbreviated exposure as three minutes at 400 deg. C. The tests in the mill with aluminium annealed by short-time exposures to heat, demonstrated that metal so treated fulfils the draw-press requirements, and that the percentage of defective shapes was smaller than with similar metal annealed by an exposure for, say, 24 hours at 370 deg. C. The experiments were made upon aluminium of the following analysis: copper, 0.25 per cent.; iron, 0.45 per cent.; manganese, trace; silicon, 0.35 per cent.; aluminium by difference, 98.95 per cent. The samples were exposed to various temperatures and for various lengths of time, the annealing being done in a small electric furnace of the resistance type. Temperatures were measured with the Northrup Pyrovolter, using base metal couples which had previously been calibrated by the usual methods. The samples were annealed by placing them in the already heated furnace, allowing them to remain for the required time, and then withdrawing them so that they cooled in air. Not over five samples were annealed at a time, and the individual pieces were separated by small pieces of light-gauge aluminium sheet, so that free access of heat could obtain in all parts of a pile. Conditions were maintained as nearly alike as possible, and all samples had identical treatment other than for the variable factors of time and temperature. The samples were considered to be softened when the Shore hardness number was 4-5, and indentation values, secured with the Erichsen apparatus, served as a guide to their drawing qualities. From the present results, it appears that the tendency toward blistering increases with the increased thinness of the sheets; however, for the times and temperatures employed, visual examination showed that the blistering was not so severe, except in a few cases, as to ruin the sheets. What blistering did occur was usually very slight, and required careful examination to observe it. The formation of blisters also seems to be associated with the higher temperatures, *i.e.*, the tendency increases with more elevated temperatures. Annealing tests made in an oxygenated atmosphere, obtained by leading tank oxygen into the furnace, showed that this condition of the furnace atmosphere did not influence the formation of blisters. Tests in a reducing atmosphere were not performed. While conclusive evidence is not at hand, blisters appear to be associated with the escape of occluded gases from the metal on heating, and it has been observed that blisters invariably form at or near the position of occluded dross in the sheets. It has been observed that if the annealing is effected by an exposure of, say, 24 hours at about 370 deg. C., that a heavy percentage of defective shapes results from the draw-press operation. In an observed instance on a large number of drawn blanks (4,400) this was 30 per cent. In order to test the effectiveness of short annealing, 200 cold-rolled No. 22-gauge circles were annealed for three minutes at 475 deg. C. and drawn in a typical draw-press operation into a given shape; there was but one defective shape resulting from rupture in the press, or a scrap loss of 0.5 per cent. Other tests made on various gauges of sheet which had been annealed for relatively short times, ranging from five to sixty minutes, gave scrap losses of less than 1.0 per cent. in all cases. The author urges investigators to consider the possibilities of abbreviated exposures at various temperatures as being able to confer workable properties upon the metal, and concomittantly to effect this with less fuel, in shorter time, and with a smaller percentage of defectives in the subsequent drawing.

The Effect of Progressive Cold Work upon the Tensile Properties of Pure Copper.—In this paper, presented to the Institute of Metals last week, Mr. W. E. Alkins gives an account of an inquiry into the change in tensile strength of copper in the form of wire as it is progressively hardened by cold drawing in the ordinary way. Earlier experiments have been carried out by Messrs. Thomas Bolton* and D. R. Pye.

While the experimental results give a smooth curve for the tensile strength against diameter or sectional area, they at the same time show conclusively that the effect of a certain amount of cold work at any stage is intimately connected with the previous history of the metal. Thus, there is one stage in the drawing at which a reduction of area of almost 10 per cent. (from 0.372 in. to 0.348 in. diameter) is accompanied by no change in tensile strength.

It appears that in the drawing of copper the phenomena which present themselves are not of that simple nature which the amorphous theory would lead us to expect. That theory regards the process as continuous, in that further cold work always produces more amorphous material and gives therefore increased hardness. Yet it is shown that over a limited range reduction in area by cold work is accompanied by no change in tensile strength—and of this the amorphous theory, as at present interpreted, offers no explanation. It appears legitimate, in the absence of quantitative data, to assume that the amount of cold work actually performed on a metal during drawing is measured by the decrease in cross-sectional area; granting this assumption, it is concluded that two distinct changes occur during the hard-drawing of copper which do not occur simultaneously. Some further evidence in support of this view has been obtained, and will be brought forward later. The variation of several other physical properties of the metal as it was drawn down was investigated, and such varied properties as density, elongation—both general and at fracture—scleroscope hardness, and so on, were all found to change in a similar way to tensile strength. Thus, for example, the density becomes constant over a limited range at 8.889, which corresponds to the specific volume 0.11251, the values for the annealed bolt being 8.9165 and 0.11214 respectively. In the case of every property investigated analogous results were obtained. It is intended that a full account of this and of further work shall form the subject of a subsequent paper. As a tentative explanation of the results recorded, it is suggested that: When copper is subjected to cold work by drawing through dies, the first change which occurs is allotropic in nature; after this change is complete, *i.e.*, presumably, when the whole of the metal has undergonne transformation, a second change sets in, which may be regarded either as allotropic or as explicable on the lines of the amorphous theory; of the two possibilities, the latter appears to be the more probable.

Further experiments now in hand will perhaps throw more light on the whole question of the applicability or otherwise of the views of Cohen to the phenomena under investigation. It should be borne in mind that there is no experimental proof that an allotropic change *precedes* the formation of amorphous metal; apparently the changes might occur in the reverse order, though this would involve the transformation of amorphous into crystalline metal by the action of cold work. In this connection it is worthy of note that amorphous copper itself must be regarded as an allotropic modification, and therefore to assume the amorphous theory of the hardening of metals is to postulate the occurrence of allotropy amongst the metals. The effect of progressive cold-drawing upon pure copper resolves itself into two distinct phenomena, which may perhaps best be regarded as an allotropic change followed by a second transformation, probably to be explained on the lines of the amorphous theory.

* Elec. Rev., January, 1907.

Possibilities with Higher Steam Pressures.—In an article in the *Electrical World* of July 13th, Mr. Eskil Berg states that with steam at 800 lb. pressure and 800 deg. F., 1 kw.-hour could be produced on 11,750 b.th.u.; also that sufficient superheat only to reduce the condensation in the turbine to a practicable minimum was found advisable. The practical gain by superheat was about 2¼ times as great as the theoretical. By far the most important loss was that due to friction in nozzles and blades and windage loss of disks and blades. It was this loss that was reduced by the use of superheat. The use of a 200-deg. superheat would reduce the friction and windage loss about one-quarter.

High steam pressure with no superheat had the disadvantage of producing more moisture through the turbine. It was therefore advisable to combine high pressure with superheat so as to produce a more efficient turbine.

With steam pressure of 200 lb. gauge, 150 deg. superheat (temperature of 538 deg.), and a vacuum of 28.5 in., the present practice of turbine plants in America, the ratio of maximum available heat for work to the total heat was only about 31.25 per cent. In Europe, however, steam temperatures as high as 700 deg. Fahr. were now used (corresponding to a steam pressure of 500 lb. and 233 deg. superheat), so the ratio of available heat was about 36.3 per cent. This permitted a fuel saving of 16 per cent., compared with conditions in America.

Turbine generator sets were now built having an over-all efficiency of more than 80 per cent., including generator losses, which, with a boiler efficiency of 80 per cent., would give an efficiency from fuel amounting to $36.3\times0.80\times0.80=23.25$ per cent. Since 1 kw.-hour=3,412 b.th.u., the b.th.u. required to produce 1 kw.-hour at the switchboard=$3,412\div0.2325=14,675$. On the other hand, if 800 lb. pressure and 800 deg. temperature were used, the efficiency would be 38.75 per cent., and with a boiler efficiency of 88 per cent. (obtainable with liquid fuel, forced draught and preheated combustion air) a kilowatt-hour could be obtained on $38.75\times0.88\times0.85=29$ per cent., or $3,412\div0.29=11,750$ b.th.u. This was equivalent to $11,750\div19,000=0.62$ lb. of fuel oil per kilowatt-hour.

Diesel-engine advocates now claimed about 0.55 lb. of fuel oil per kilowatt-hour, but this was obtained only with a fuel about 50 per cent. higher in price than that which could be satisfactorily burned under a boiler. When full advantage had been taken of the various processes that were used in transforming the energy of the fuel into mechanical energy through the medium of steam, the steam process compared quite favourably with results obtained at the present time with internal-combustion engines.

In a discussion on this subject which took place at a joint meeting of the Western Society of Engineers and the Chicago sections of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers lately, questions arose as to the practicability of obtaining piping and equipment that would withstand higher pressures and superheats, whether the increased cost of the equipment would keep pace with the gain in economy, the probability of higher radiation losses, the possibility of superheat high enough to give dry steam at the turbine exhaust, the possible advantages

of resuperheating the steam for the lower stages with the waste heat from the boilers, and the interference of economisers in obtaining the theoretical advantages from higher pressures and superheat.

To show that the design of equipment for the higher pressures mentioned was not impracticable the author referred to the case of De Laval, in 1897, supplying all the electrical energy for lighting the Exposition of Arts and Industries in Stockholm with turbo-generating sets operated from boilers of his own design using over 1,500 lb. pressure. Of course the units were small, four being rated at 100 H.P. and two at 50 H.P. each.

To get dry steam at the exhaust in the average turbine would require excessive superheat. Enough superheat to reduce the moisture to 5 or 6 per cent. at the turbine exhaust was about the practical limit.

The author held that the cost of high-pressure equipment would be less than that of present equipment. This applied particularly to the boiler. Smaller tubes could be used, say, of 1-in. (2.54 cm.) diameter, and the boiler could be smaller, lighter and cheaper than boilers carrying the lower pressures of to-day. All auxiliaries would have to be redesigned, and it would probably be best to eliminate joints and weld the piping system solid.

There would be a little more moisture from condensation at the casing. The use of the flue gases for resuperheating the steam for the lower stages would necessitate splitting the turbine into two elements, so that the residual velocity would be lost, causing a drop of 5 or 6 per cent. in efficiency. It would also introduce undesirable complications. However, there might be a gain in using an oil-fired superheater for the purpose, allowing the gases to pass into the boiler.

A 45,000-KW. Compound Turbo-Generator.—An unusually well-illustrated description of a 45,000-KW. cross-compound reaction Westinghouse turbine recently put in commission at the South Street station of the Narragansett Electric Lighting Co., Providence, R.I., is given in *Power* of August 27th. The turbine is of the double-unit type, consisting of a high and low-pressure turbine, each connected through a flexible coupling to its own generator, having a capacity of 22 500 KW., and mounted on separate bedplates supported on foundations lying parallel to each other. The energy given up by the steam at full load is equally divided between the high and low-pressure turbines, the generators dividing the load in half; at lower loads a greater proportion is carried by the high-pressure element. The unit was designed to operate with a steam pressure at the throttle of 200 lb. with 100° F. superheat, and a vacuum of 29 in. at the exhaust, while the generators have a capacity of 23,750 K.V.A., 11,000 volts, three-phase, 60 cycles, at 0·95 power factor, the high-pressure element having a speed of 1,800 R.P.M. and the low-pressure 1,200 R.P.M. It is stated that the condenser equipment for this turbine consists of the largest condensing apparatus in the world. The unit is composed of two separate and distinct low-level jet condensers, which can be operated together or separately, if necessary.

Electric Welding in Shipbuilding.—It is stated in the daily Press that Lloyd's Register, having already approved one system of electric welding in shipbuilding, as recently announced in our pages, is now prepared to consider other similar applications from any electric welding companies, with a view to their processes being recognised by the Society, and to their names being added to a list of companies whose processes have been approved as fulfilling the Society's conditions.

The Whitley Report and State Service.—The recent Trade Union Congress at Derby carried by 2,374,000 votes to 753,000 a resolution calling upon the Government to apply the principles of the Whitley Report to all Departments of State service. The A.S.E. spokesman voiced the opposition of that organisation by saying that while the Whitley proposals were all very well for sections of industry which could only secure justice by Wages Boards and other forms of State interference, when they reached the stage where the organised workers by virtue of their own organisation were able to make a definite claim, and back it up, they did not need them. The Locomotive Engineers, through their representative, expressed a similar opinion. "They had had too much of the balancing power between employers and employed around a table. They wanted a little more of the ascendancy of Labour at the negotiation table, so that their claims should be granted. They wanted not conciliation but right and justice." The postal clerks, it seems, regard the Whitley scheme as a stepping-stone, affording them insight into the administrative side of the undertaking, so as to equip them better for successful democratic control. The shipbuilding industry was stated to have thrown over the report, and the carpenters and joiners also opposed it. The debate, as reported, seems to have limited itself practically to speeches in opposition to the motion: indeed, according to the *Times*, the whole discussion did not occupy more than 15 minutes.

The A.S.E. Amalgamation Proposals.—According to the *Daily Telegraph*, the proposals submitted by the Amalgamated Society of Engineers for the amalgamation of the Unions in engineering, shipbuilding, and cognate trades were further discussed at a Conference at York, last week. "The delegates, representing 13 Unions, unanimously adopted a resolution declaring themselves in favour of the principle of amalgamation, and appointed a Sub-Committee to draw up a scheme. It was stated that if the scheme for amalgamation succeeded, it would embrace nearly 600,000 members, and would thus become the most powerful union of skilled craftsmen in the United Kingdom."

Educational.—MUNICIPAL COLLEGE OF TECHNOLOGY, UNIVERSITY OF MANCHESTER.—We have received the prospectus of University courses for the coming session. Prof. Miles Walker is the head of the Department of Electrical Engineering, and Prof. G. G. Stoney of the Department of Mechanical Engineering. The Michaelmas term will commence on October 3rd, and students will be enrolled on September 30th and October 1st and 2nd. We have also received Vol. IX of "Technology," the record of investigations undertaken by members of the College, which was previously styled the "*Journal* of the School of Technology."

Electric Steel Production.—A recent development in the metallurgical industry which merits comment is the very great increase in the production of steel made by electric furnaces. According to Prof. H. C. H. Carpenter, F.R.S., of the Imperial College of Science and Technology, previously to the war the output was so small that it did not figure in any returns of steel production. Nevertheless, in 1917 no less than 110,000 tons of electric steel was made, of which 90,000 tons was in the form of ingots and 20,000 tons in castings. At the present time upwards of 50 furnaces are at work in the various Sheffield works.

Electric Steel Furnaces in the U.S.—Mr. H. C. DuBois, of the Chemical and Explosives Division of the U.S. War Industries Board, Washington, stated in a letter, says the *Iron and Coal Trades Review*, that at the present time the Board was discouraging anyone from starting new furnaces on electric steel, because the Steel Division of the Board had reported that its records showed that at the present time electric steel production was somewhat in excess of the demand and the electrode situation was critical. The Board could not encourage any further consumption of electrodes where the product made by the use of such electrodes was not of vital importance. Mr. Carl H. Booth, president of the Booth-Hall Co., in reply to this letter, sent a protest to the Steel Division of the War Industries Board, pointing out that only two months before, Mr. J. L. Replogle had made a public statement that the steel demands for building ships and the requirements of the Army and Navy were very great.

Appointments Vacant.—Shift engineer (73s. 6d.) for the Dewsbury Corporation Electricity Department; engineer-in-charge (£173) for the Tunbridge Wells Corporation Electricity Works. See our advertisement pages to-day.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Oxford Street, W. 1.

Corps Orders No. 39, by Lieut.-Colonel C. B. Clay, V.D., Commanding:—
Captain of the Week.—Capt. W. Darley Bentley.
Next for Duty.—Capt. E. G. Fleming.
Sunday, September 22nd.—Annual Musketry Course at Pirbright. Parade, Waterloo Station, 8.45 a.m. Dress: Drill Order, with rifles. Mid-day and tea rations to be carried.
Monday, September 23rd, to Saturday, September 28th.—Drills as usual.
Sunday, September 29th.—Commandant's Parade, Waterloo Station, 8.45 a.m., for work at Esher. Dress: Drill Order, without rifles. Mid-day and tea rations to be carried.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

The Industrial Reconstruction Council.—The first annual general meeting of this Council was held on Tuesday at the Institute of Journalists, the chairman, Mr. E. J. P. Benn, C.B.E., presiding over a large gathering. In his *résumé* of the present year's work Mr. Benn remarked on the growth of public interest in the problems of industrial reconstruction after the war. It was the first topic discussed in all quarters and by all classes. He ventured to hope that it was in no small measure due to the efforts of the I.R.C. that the principle underlying the Whitley Report was now so widely accepted, and that everywhere our industries were awakening to the need for closer organisation. The I.R.C. held fast to its watchword of Industrial Self-Government, and by insisting on the only sane interpretation of that phrase, was, he thought, doing useful work in counteracting the dangerous revolutionary influences that were abroad. Mr. Benn gave a brief summary of the year's activities in the way of meetings, lectures, conferences, and the publication and distribution of literature, and made a strong appeal to those present to secure fresh adherents to the cause, and thus further the possibilities of future development. Lieut.-Col. E. Pottinger, D.S.O., organising secretary, in presenting the financial statement, announced that the autumn work in the provinces would largely consist in the establishment of Branch Reconstruction Associations, which should keep local interest and enthusiasm constantly stimulated in each industrial centre.

Lightning Explodes a Boiler.—In a letter to *Power*, Mr. A. W. Kirby describes how a steam boiler that was installed at a laundry at Baldwin City, Kan., was exploded by lightning. The boiler was of the marine type, and had been in service less than a year; it operated at less than 100 lb. pressure, although the safety valve furnished by the builders was set at 120 lb., and at times the pressure reached that point. At the time of the explosion the boiler was carrying 80 lb., and had about 3 in. of water in the glass. When the lightning struck the boiler house, the boiler immediately exploded, blowing out both ends of the building and throwing the boiler about 70 ft. from its original position. The boiler was mounted on wooden skids, and was not very well earthed, and so made a fair mark for lightning. The top of the safety valve was blown off, and the large flue was ruptured at the back seam, while some of the rivets were pulled through the sheet, and some sheared. Had it not been that two persons saw the lightning strike the boiler room, the cause of the explosion would have been doubted. There was a whistle above the roof, and it is said that the lightning struck this whistle first.

Inquiry.—A correspondent wishes to get into touch with a British firm that is working the Schoop spraying process, especially in connection with the coating of cloth, &c.

Electric Heating Appliances in America.—The War Services Committee of the Electric Heating Appliance Manufacturers held a conference in Washington, last month, with the Priorities Committee of the War Industries Board, the object being to supply information and evidence to the latter Committee on the conservation of raw material, fuel, and labour in the manufacture, use, and sale of electric heating appliances. There are 190 manufacturers of such appliances in the United States, and the volume of business for 1917 amounted to $13,000,000. The electric heating-appliance work given a "Class A" priority by the Committee consists of ranges, ovens, and other cooking equipment, air and water heaters, soldering irons, glue pots, and electrically-heated clothing, &c., for use in the Army, Navy, hospitals, and munition works. The Priorities Commissioner asked the Committee to go through the industry and use freely the knife, and "cut right down to the quick" every appliance produced that was not essential, so as to reduce the consumption of raw materials.—*Electrical World.*

Coal From Peat.—Mr. Samuel C. Davidson, chairman of the well-known Sirocco Engineering Works, Belfast, has patented a method of treating peat and forming it into synthetic coal, which should in some measure meet the serious shortage in the Irish supply at the moment, and assist eventually the British supply. Mr. Davidson's method consists of putting back into the peat certain oils washed away from it owing to its proximity to the surface of the land, previously disintegrating it and mixing it with 15 per cent. of pitch dust. The pulp thus formed is subjected to hydraulic pressure, which turns out square blocks of fuel, which burn well. Many attempts have been made in Ireland to treat peat in a manner that would give it the approximate heating and lasting qualities of coal, but most of these were failures. Mr. Davidson's process is simple and comparatively cheap. Peat in Ireland is running up to the unheard-of price of £2 10s. per ton.

The New List of Certified Occupations.—As we receive from time to time questions from correspondents respecting their position under the Military Service Acts, we would recommend all who are in any doubt as to the age and medical grade at which they come under protection to secure a copy of the new List of Certified Occupations (R 136 Revised), which comes into force on September 26th. It can be obtained through any bookseller, or direct from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, price 1d. It supersedes all previous lists of Certified Occupations. The conditions determining a claim to be in a certified occupation are stated, and it should be noted that no man employed in any of the certified occupations specified is covered unless he was employed in the same occupation (not necessarily by the same employer) on or before January 1st, 1918, and has been since so employed. If a man has not been examined and placed either in a medical grade or in a medical category he will be regarded as in Grade I. We select a few of the more directly electrical employments for quotation here:—Directing heads, managers, or departmental managers of businesses are certified if in Grade I or II, if born before 1875.

	Man certified if born in or before the year stated.	
	Grade I.	Grade II.
MAINTENANCE AND REPAIRING STAFF:—		
Mechanic, Electrician or Electrical Fitter, Mill Joiner, Bricklayer, and other skilled men wholly or principally engaged in the maintenance or repair of their employers' plant, machinery, or tools	1884	1888
[For Electrician or Electrical Fitter engaged in the maintenance, running, or repair of motors and other electrical plant, in factories other than their employers', see under Electrical Engineering.]		
ENGINEERING WORKS AND FOUNDRIES engaged in manufacturing or repairing machinery or plant, or power-driven vehicles for use in trade or industry:—		
(a) Foreman	1882	1885
(b) Fitter; turner; erector; pattern maker; moulder or other skilled workman	1882	1885
**(c) All other classes of workmen	1874	1877
ELECTRICAL ENGINEERING:—		
(a) Foreman	1882	1888
(b) Turner; fitter; erector; electrician or other skilled workman	1882	1888
(c) Wireman	1880	1888
**(d) All other classes of workmen	1874	1877
LOCAL GOVERNMENT AUTHORITIES:—		
Officials on the Administrative or Technical Staffs (excepting those in trading undertakings carried on by Local Authorities, or in other classes mentioned elsewhere in the List)	1883	1885
ELECTRICAL GENERATING STATIONS, TRANSMISSION AND DISTRIBUTING MAINS AND LINES (including those for Tramway Undertakings and Electric Railways):—		
(a) Station engineer; shift engineer; sub-station attendant-in-charge	1890	1893
(b) Switchboard attendant; cable jointer; overhead lines man; electrical fitter (sub-stations); engineman; stoker	1888	1890
**(c) All other classes of workmen	1875	1877
RAILWAY SERVICE, INCLUDING WORKSHOPS AND SHEDS:—		
Man in respect of whom the Railway Company have furnished to the appropriate local officer of the Ministry of National Service a certificate stating that he is indispensable to the Company	1894	1894
BOILER INSURANCE COMPANIES:—		
Boiler, Machinery, or Electrical Inspector; Technical Office Staff	1888	1890

** To be within the certification, a man in Grade III must have been born on or before the year 1903.

Fatality.—Alexander Cameron, a Glasgow tramway motorman, was accidentally killed at Partick depôt at midnight on Saturday. According to a Press report, he had brought his car into the depôt, and the conductress, after reversing the trolley, had gone into the office with her cash. Cameron, observing that the trolley had jumped from the wire, left his platform to adjust it, but he had apparently left the controller on, and immediately the trolley touched the wire the car bounced forward, knocking him down. His body was almost severed in two by the wheels.

Carbide of Calcium in Germany.—It has just transpired that a large power station of a capacity of 25,000 KW. has been built at Kattowitz, Upper Silesia, during the course of the war, and is now in regular operation, together with plant for the production of 20,000 tons of carbide of calcium per annum. The combined undertaking has been carried out in connection with the utilisation of coal from the Prince Pless coal mining fields. The management of the latter has now entered into an agreement with the metal firm of Beer, Sonderheimer & Co., of Frankfort-on-Main, to form a company under the title of the Prinzengrube Power and Smelting Works Co. for the purpose of taking over the power station and carbide works, the share capital being £450,000 and the proposed loan capital £300,000. Each of the two parties to the agreement has acquired one half of the share capital, no banks having any participation, and the contract includes arrangements for the delivery of coal from the Pless mines.

Institution Notes.—Institution of Municipal Engineers.—On the occasion of the annual general meeting at Southall, Middlesex, on October 9th and 10th, a visit is to be paid to Messrs. Lowden's lamp works, where the complete manufacture of incandescent electric lamps will be seen.

Municipal Tramways Association (Inc.).—The annual meeting will be held at the Town Hall, Leicester, on September 20th and 27th. The Executive Council will meet at the Town Hall at 10 a.m., and there will be a reception by the Mayor of Leicester (Ald. North, J.P.), and the Leicester Tramways Committee, at 10.30 a.m., followed by the general meeting at 11 o'clock. Ald. S. Flint, J.P., chairman of the Leicester Tramways Committee, will deliver his presidential address, and Mr. E. Hatton (Newcastle-on-Tyne) will read a paper on "The Post-War Position of Electric Power Supply," the discussion being opened by Mr. J. M. McElroy (Manchester). The Mayor will give a luncheon at 1 p.m., and on the resumption of the meeting at 3 p.m. the report of the Executive Council on the formation of a National Joint Council for the Tramway Industry will be considered, a statement on the subject being made by Mr. McElroy.

On the following day the Executive Council will meet at 10, the Managers' Section at 10.30, and the business meeting of the Association will be resumed at 11 to receive the report of the Executive Council and the Treasurer's statement, and to elect officers. At 1 p.m. a luncheon, given by the President of the Association, Ald. S. Flint, will conclude the proceedings.

Electrical Power Engineers' Association.—A meeting will be held at the Terminus Hotel, Brighton Station Gates, Queen's Road, Brighton, on Monday, the 23rd inst., at 7 p.m., to discuss the formation of a South-Coast Branch of the above Association. Mr. A. C. Bostel, chairman of the London and Southern Division, will address the meeting. All technical engineers engaged in the electric supply industry are heartily invited, and it is hoped that as many as possible will make a special endeavour to attend.

A Liverpool Electricians' Strike.—The strike of electricians at Liverpool has been temporarily settled. The Electrical Trades Union and the Ministry of Labour were successful in persuading the men to resume work, pending further negotiations on the non-Union question, which was the cause of the dispute.

It will be remembered that the strike was the result of a movement on the part of the Electrical Trades Union to compel supervising engineers, foremen, and charge hands to join their Union. In this connection it is interesting to note that the National Association of Supervising Electricians has been registered as a Trade Union, and, of course, provides for precisely the class of men to which the agitation relates.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The salary of Mr. A. R. DAYSON, manager of the Sunderland Corporation tramway department, has been increased from £600 to £700 per annum.

Mr. WM. FORBES, formerly traffic superintendent of the Aberdeen tramways, has been appointed manager of the system, in succession to Mr. R. S. Pilcher, who was recently appointed manager of the Edinburgh tramways.

Luton Town Council has increased salaries of the electrical engineer's staff as follows: Mr. H. A. KELL, chief assistant, from £265 to £300 a year; Mr. A. H. GATES, chief technical

assistant, from £250 to £280; and Mr. R. Harding, chief clerk, from £200 to £225.

Blackburn Corporation Electricity Committee has recommended a grant of £500 to Mr. P. P. Wheelwright, the borough electrical engineer, for extra work performed in connection with Government supplies.

The Walsall Council has approved of the recommendation of the Tramways Committee mentioned last week, advancing the salary of Mr. R. L. Horsfield, the tramways manager.

Mr. Hugh Purves, lately manager of the Capetown Corporation's electric light works, Dock Road, Capetown, has been appointed electrical engineer at Paarl, Cape Province, in place of Mr. Wragg, who recently resigned.

Mr. A. Dimmack, electrical and mechanical engineer to the Swindon Council, has resigned his position, he having received a temporary appointment under the Admiralty. The Council has decided to retain his services in connection with certain special matters, and to consider later the question of an honorarium for extensions carried out for particular works.

Lance-Bombardier H. W. Hammond, who joined the R.G.A. in October, 1916, and was sent to Hong-Kong, where he has been acting as Master Gunner's assistant, has been seconded to the Kowloon-Canton Railway Co., for temporary appointment as traffic inspector on the British section of the line. He is the son of Mr. W. E. Hammond, traffic manager of the Metropolitan Electric Tramways, Ltd., and vice-chairman of the Metropolitan Association of Electric Tramway Managers. Lance-Bombardier Hammond joined the staff of the Metropolitan Electric Tramways, Ltd., in 1904; he was transferred, in 1913, to the British Electrical Federation, and three years later to the London Electric Railways, both the latter appointments being in the claims departments.

General.—Mr. Albert Vickers, on account of his advanced years and failing health, has placed his resignation of the chairmanship of Vickers, Ltd., in the hands of the board. Mr. Douglas Vickers has been appointed chairman.

Mr. Austin Hopkinson, electrical engineer, Manchester, son of Sir Alfred Hopkinson, has been adopted as prospective Conservative candidate for the newly-formed Mossley Division of Lancashire.

Mr. R. W. Dalton, H.M. Trade Commissioner in New Zealand, arrives in this country about the middle of October on his official visit. He will be at the disposal of manufacturers and others desiring information regarding New Zealand trade during his stay in London, and his tour of provincial centres which is to follow. Those who desire to make appointments should write to the Comptroller-General, Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, using the reference number D.O.T. 36,732/18.

Dr. H. S. Hele-Shaw and Dr. Guglielmo Marconi have been elected Honorary Fellows of the Society of Engineers.

Roll of Honour.—Lance-Corporal G. H. Robinson, City of London Yeomanry (Rough Riders), an apprentice with Messrs. Foote & Milne, Ltd., and son of Mr. G. W. Robinson, who is estimator to the firm, was captured near Jerusalem last November. He is now reported to have died of dysentry in January in Asia Minor.

Lance-Corporal A. Y. Young, who has been killed at Salonica, was formerly employed in the Glasgow Electricity Department.

Lance-Corporal L. D. Adlington, reported killed in action, was employed at the Birmingham Electric Supply Department.

Private W. U. Priestley, London Regiment, an apprentice engineer at Blackpool Electricity Works, has been wounded.

Lance-Corporal I. Pitsforth, who has died of wounds, was employed in Bradford as an electrical engineer.

Lieutenant Mozley, R.E., son of Mr. H. Mozley, the manager of the Burnley Corporation Tramways, has been promoted to the rank of Captain.

Lieutenant F. Emerson, L.R.B., killed in action, was in private life in business with his brother, Mr. R. B. Emerson, at Southend-on-Sea, as an electrical engineer.

Gunner L. Haynes, Tank Corps, reported killed after being missing since November, 1917, was with Messrs. Siemens Bros., of Stafford.

Driver A. C. Collins, R.F.A., who was on the Wallasey municipal tramway staff, has been awarded the Military Medal.

Lieutenant H. F. Driver, M.C., who has fallen in action, was articled to Messrs. Bailey, Grundy & Barrett, Ltd., electrical engineers, of Cambridge. He had gained the Military Cross.

Sapper J. Cartmell, R.E., who has been killed in action, was 27 years of age, and was an electrician with the Blackpool Tower Co.

Sub-Lieutenant W. Chapman, Naval Division, who has fallen in action, was a member of the Manchester Corporation Electricity Department staff.

Sapper F. Williamson, R.E., who has died of wounds received during a night attack, served at the Dardanelles before going to France. He was employed at the generating station, Taine Valley, Dukinfield.

Sergeant J. Bird, Gordon Highlanders, who has died of wounds, was an employé of Messrs. Dick, Kerr & Co., Ltd., Preston.

Private W. Haigh, Essex Regiment, who has been killed in action, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Obituary.—Mr. W. S. Insull.—Mr. W. Samuel Insull, whose death occurred in London last Saturday, at the age of 86 years, was the father of Mr. Samuel Insull, the well-known electrical authority in the U.S.A., who went to America some thirty years ago.

NEW COMPANIES REGISTERED.

Remco Carbon Co., Ltd. (151,393).—Private company. Registered September 10th. Capital, £7,625 in 7,500 ord. shares of £1 each, and 2,500 def. shares of 1s. each. To carry on the business of manufacturers of, and dealers in, electrical apparatus of all kinds used in connection with supply of electricity for heat, light, power, telegraphy, &c. The subscribers (each with one ord. share) are:—C. Oliver, Milton Ironworks, Gravesend, electrical engineer; W. M. D. Tell, Viggory Mead, Horsell, Woking, electrical engineer. The first directors are to be appointed by the subscribers. Solicitor: E. P. Bilbrough, 5, Fenchurch Street, E.C.

Andrew Ness, Ltd. (151,386).—Private company. Registered September 10th. Capital, £60,000 in £1 shares (30,000 pref.). Engineers, contractors, electroplaters, electrochemists, ironfounders, metal depositors, refiners, and inlayers, metallurgists, &c. Agreements with A. Ness, the Canonbury Engineering Co., Ltd., and the Plessy Co., Ltd. The subscribers (each with one pref. share) are:—Ethel M. Lawrence, 139, Plimsoll Road, Highbury, N. 2, solicitor's clerk; C. Bowen, 7, Ely Place, E.C. 1, solicitor. The first directors are: A. Ness, J. S. Elliott, J. F. Carr, A. W. Browne, and Q. Marino. Registered office: 147, Cottenham Road, Upper Holloway, N.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Duram, Ltd.—Particulars of £20,000 7½ per cent. debentures, created June 11th, 1918, filed, the whole amount being issued on September 2nd. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

F. & A. Parkinson, Ltd.—Mortgage dated September 2nd, 1918, to secure £2,750 charged on land at Nether Moors, Guiseley, and dwelling-houses, &c., erected thereon (Greenshaw Terrace, Guiseley). Holders: Bradford Third Equitable Benefit Building Society, Bradford.

Anglo-Portuguese Telephone Co., Ltd. (24,545).—Capital, £200,000 in £1 shares. Return dated June 5th, 1918. 150,000 shares issued; £51,046 paid; £98,954 considered as paid. Mortgages and charges: £33,160.

Blackburn, Starling & Co., Ltd. (61,302).—Capital, £12,000 in £1 shares. Return dated July 24th, 1918. All shares taken up; £8,100 paid; £3,900 considered as paid. Mortgages and charges: Nil.

Anchor Cable Co., Ltd. (69,073).—Capital, £250,000 in £10 shares. Return dated July 25th, 1918. 6,500 shares issued; £61,000 paid; £4,000 considered as paid. Mortgages and charges: £50,000.

Barnsley & District Electric Traction Co., Ltd. (72,962).—Capital, £50,000 in £5 shares (5,000 pref. and 5,000 ord.). Return dated June 11th, 1918. 4,460 pref. and 4,007 ord. shares issued; £42,035 paid; mortgages and charges: £21,000.

British Thomson-Houston Co., Ltd. (47,982).—Capital, £800,000 in £10 shares (40,000 ord. and 40,000 pref.). Return dated July 31st, 1918. All shares issued; £725,310 paid on 32,531 ord. and 40,000 pref.; £74,690 considered as paid on 7,469 ord. Mortgages and charges: £168,195.

Babcock & Wilcox, Ltd. (65,805).—Capital, £1,960,000 in 100,000 6 per cent. pref., 300,000 5 per cent. second pref., and 1,660,000 ord. shares of £1 each. Return dated June 6th, 1918. 100,000 6 per cent. pref., 179,056 5 per cent. second pref., and 1,660,000 ord. taken up; £539,056 paid on 360,000 ord. and 179,056 second pref.; £1,400,000 considered as paid on 100,000 6 per cent. pref. and 1,300,000 ord. Mortgages and charges: Nil.

CITY NOTES.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Oriental Telephone & Electric Co., Ltd.—110,087 additional ordinary share of £1 each, fully paid (Nos. 179,364 to 289,450).

Tees Power Station Co., Ltd.—£600,000 6 per cent. first mortgage debentures of £100 each (Nos. 1 to 6,000) (registered).

Rees Roturbo Manufacturing Co., Ltd.—The available balance at September 30th, 1917, amounted to £66,730. After adding to depreciation reserve £18,000, and placing to general reserve £25,000, it is proposed to pay dividends on the preference shares for the two years and two months ended December 31st, 1911, at 5 per cent., and to carry forward £17,143. Owing to certain rumours about the company, the directors wish to state that they are not negotiating for the sale of the business or works at Wolverhampton.—*Financial Times.*

American Telephone & Telegraph Co.—Two per cent., less income tax, for the quarter.

East Anglian Engineering Co., Ltd.—At the annual meeting, at Stowmarket, on September 7th, Mr. L. Tibbenham presiding, supported by Mr. Drury Stowe, director, it was resolved that, after allowing for depreciation, reserve for bad debts, and directors' fees, a dividend of 6 per cent. be paid to all shareholders. A vote of thanks was passed to the chairman for the successful working of the concern. This is the first dividend paid since the company's formation in 1898.

Official Announcement re Companies.—The following are to be struck off the list within three months unless cause is shown to the contrary:—

Aero Fire Alarm, Ltd.
Asbestos and Asbestic Co., Ltd.
Curative Electricity Co., Ltd.
"Float" Electric Co., Ltd.
Platinum Substitutes, Ltd.

British Insulated and Helsby Cables, Ltd.—Interim dividend of 9d. per share, less tax.

British Aluminium Co., Ltd.—Dividend at the rate of 8 per cent. per annum, less income-tax, on the ordinary shares, and at the rate of 6 per cent. per annum, less income-tax, on the preference shares, both for the six months to June 30th.

Bromley (Kent) Electric Light & Power Co., Ltd.—Interim dividend at the rate of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares for the half-year.

Mackay Companies.—Quarterly dividend 1½ per cent., less tax, on common stock.

Eastern Extension Telegraph Co., Ltd.—Second quarterly interim dividend 3s. per share, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

The condition of Stock Exchange business is not unsatisfactory in some of the markets, although, taking the House as a whole, it cannot be said that there is much going on. The proposals put forward by the Austrian Government for a non-committal peace conference were regarded as an indication that one partner of the enemy has had more than enough of the war, and, although no special importance was attached to this, it serves to underline the confident sentiment produced by the advance of the Allies. Therefore, prices are good, the most surprising stock in the list being Consols, which have risen rapidly until they stand on a level showing a return of about 3 per cent. net on the money, allowing for income-tax at 6s. in the £.

Metropolitans have fallen back to 26, so that for a day or two they stood at the same price as Districts, a curious position seeing that the latter have had no dividend for 36 years, whereas the Metropolitan has paid poorly indeed, but regularly. The curtailment of railway services next month is expected to provide the tubes and 'buses with an ever-increasing amount of traffic, although the issues of the Underground Electric Railways of London have not improved, the £10 shares, indeed, being ¼ easier for lack of attention from its recent supporters. Districts have receded ¼. In the trustee group there is £5,000 Metropolitan 3½ per cent. preference on offer at 57¼, at which the return to an investor comes to just over 6 per cent. on the money, with a fair amount of cover at the back of it. The brisk demand for these preference and debenture stocks seems singular, considering how little more the return is from them than can be obtained from the National War Bonds.

It is thought possible in the market that the electric lighting undertakings may have to reduce their dividends in view of the shortage of coal and ever-increasing demands of Labour. The Charing Cross Co., it may be recalled, passed the interim dividend in respect of the last half-year, and some think that most of the other London companies will be obliged to make a small cut in the dividends for the final half of the twelvemonth. Meanwhile, of course, the principal prop is the character of the war news, and there is no evidence of proprietors wishing to sell their shares. Most of the prices are unchanged on the week, business being as quiet as usual. Westminsters are 5s. better at 6, and Metropolitans have lost a trifle.

The main interest centres around manufacturing companies' shares. The lively dealings in British Aluminiums have come to a pause, and the price of the shares is easier on disappointment that the dividend is not increased. Ediswans continue to be an active market, and in their new guise are as popular as they were before. The price keeps in the neighbourhood of 16s. The first preference continue to be quoted about 22s. 6d., and the last business marked in the 4 per cent. first debenture stock was at 75 and 76. General Electrics remain at 18½, and the new shares became fully-paid this week. They stand about 10s. lower than their seniors. The new preference have been changing hands between 10 and 10¼. Crompton ordinary are unaltered at 16s., and the preference at £1. Babcock & Wilcox, after being a little over £4, reverted to the round figure. Metallurgical shares hold their present price of 4¼. Siemens have risen to 6¼. The telegraph manufacturing shares are very steady, with a further demand for India-Rubber, and Telegraph Constructions; the latter are 5s. higher on the week. Colliery shares are on the rise on account of the coal position, and a number of armament issues are a shade harder.

Amongst the various ex dividend markings which have occurred during the past few days, Globe Telegraph & Trust ordinary are noticeable because they have recovered the 2s. deducted from the price. City of London Electrics ordinary and preference are up on balance. The telegraph market is firm throughout. Revival of speculative interest is shown by a rise of ¼ in West India and Panama. Marconis have advanced to 4¼ bid, and are once more an animated market. Chile Telephones are ¼ up at 7½. Orientals are good at 3½. Expectation in this case is looking for an early announcement with regard to the distribution of surplus assets, and is concerned with estimates of what this is likely to be in hard cash. The idea is that shareholders will receive 25s. per share, if not more, and that this will have no effect upon the earning capacity of the company, which is likely to continue its present payment of 10 per cent. dividends without interruption. Cuba ordinary have risen 10¼, and Chiles at 7¼ are also better.

The foreign group is not so good. After their giddy rise, Mexican Light issues have come back to a slight extent, and the first mortgage bonds are 2 points down at 61. British Columbia Electric Railways remain weak and unsupported, and Brazilian Tractions lost a point of the rise which they recently achieved. The gamble which sprang up in some of the low-priced foreign shares has quieted down, but it is noticeable that quotations are well maintained.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Sept. 17, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅝	—	£7 17 0
Charing Cross Ordinary	5	4	3¾	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	8¼	—	6 18 6
Chelsea	3	5	3⅞xd	—	7 16 10
City of London	8	8	11½xd	+ ⅛	7 2 3
do. do. 6 per cent. Pref.	6	6	9⅝	—	6 3 1
County of London	7	7	9½xd	—	7 1 9
do. do. 6 per cent. Pref.	6	6	9⅝	—	6 4 8
Kensington Ordinary	6	7	8¼	—	6 17 7
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	9¼	—	7 13 10
Metropolitan	3	4	3½	— ⅛	6 10 7
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	8	9	6½	—	6 18 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6	+ ⅛	7 10 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	97½	—	6 3 0
do. Def.	1½	1½	23½	—	6 7 8
Chile Telephone	8	8	7½	+ ⅛	5 6 8
Cuba Sub. Ord.	7	7	10½	+ ¼	*6 13 4
Eastern Extension	8	8	15⅝	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	142½xd	+2/-	*4 17 5
do. do. Pref.	6	6	104½xd	—	5 17 1
Great Northern Tel.	24	22	38	+ ⅛	5 15 9
Indo-European	13	—	57½	—	5 12 6
Marconi	15	20	4¼	+ ¼	4 9 0
Oriental Telephone Ord.	10	10	3½	—	3 4 0
United R. Plate Tel.	8	8	7½	—	*5 3 3
West India and Panama	6d.	1/3	1¼	+ ¼	*3 6 8
Western Telegraph	8	8	16½	+ ⅛	*4 17 0
Home Rails.					
Central London Ord. Assented	4	4	60½	—	6 12 3
Metropolitan	—	1	26	— ½	3 17 0
do. District	Nil	Nil	25½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	2¼	— ⅛	Nil
do. do. "A"	Nil	Nil	8/-	—	Nil
do. do. Income	6	4	83½	— ½	*4 16 3
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝	—	6 9 9
Anglo-Arg. Trams. First Pref.	5½	5½	8½	—	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	67	+1	7 9 3
Brazil Tractions	—	—	47	— ½	—
Bombay Electric Pref.	6	6	10¼	-	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	58½	—2	8 11 0
do. do. Preferred	Nil	Nil	41½	— ½	Nil
do. do. Deferred	Nil	Nil	35	—1	Nil
do. do. Deb.	4½	4½	57½xd	—	7 7 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	50	—	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	28	—1	Nil
do. Pref.	Nil	Nil	40	—1½	Nil
do. 1st Bonds	Nil	Nil	61	—2	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	4	—	3 15 0
British Aluminium Ord.	10	10	1⅝	— 1/16	5 5 0
British Insulated Ord.	20	20	2⅞	+ ¼	4 6 6
British Westinghouse Pref.	7½	7½	2⅛	—	5 9 1
Callenders	20	25	10⅜	— ½	5 16 8
do. 5 Pref.	5	5	4½	+ ⅛	5 11 1
Castner-Kellner	22	20	3¼	—	5 10 4
Edison-Swan, "A"	—	—	1⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	75⅝	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10⅜	—	6 5 4
do. Ord.	10	10	18½	—	*5 8 1
Henley	25	25	2½	+ 1/16	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 16 9
Telegraph Con.	20	20	47½	+6/-	*5 1 0

*Dividends paid free of Income Tax.

THE DUTIES OF THE PROGRESS DEPARTMENT.

By W. J. HISCOX.

(*Continued from page* 261.)

The Tool Room and the Pattern Shop.

(*c*) *The Tool Room.*—As soon as the instructions (in the form of detail drawings and specification lists) are issued to the shops, the tool room and the pattern shop are the first two departments to receive the attentions of the progress man. His methods in connection with these two departments are dissimilar in some respects, so we will first of all deal with the tool room, following up our observations with regard to the tool-drawing office contained in the preceding article.

It is an understood thing in all engineering factories that you cannot hustle a toolmaker. No matter how urgent or important the job may be, he goes about his work in a quiet, methodical manner, and the progress man must use the utmost tact and discretion to deal successfully with this peculiar department. This is written quite seriously, for although on the average production-job the operator can be persuaded to extend himself to meet a certain exigency, the intricate nature of this work, and the mathematical accuracy necessary to produce a good tool, render it imperative that no influence shall be exerted with the idea of rushing the toolmaker. He is willing to do all in his power to meet the demands of the factory, as is evidenced by the fact that he often works long hours on a particularly arduous task, and the progress man will do well to remember these points, and not allow his zeal to outrun his discretion. The chief aim, therefore, of the Progress Department in this connection is to ensure for the tool room adequate time for the completion of the necessary parts, and this can be done by pressing the tool-drawing office to issue the instructions with the least possible delay.

Apart from the foregoing, it is necessary for the progress man to interest himself in tool-room production, for the head of this department is cast in the same mould as heads of other departments, and does not always give priority to the most urgent orders, unless constantly reminded of his obligations by the progress man. There is no reason why the dating system cannot be applied to this department—*i.e.*, a covering delivery date for all tools required in connection with one order, with intermediate dates, if necessary, for the completion of those tools which should be in commission first.

A complete record of all outstanding tools, &c., is kept in the Progress Department, as instanced in the previous article. From this the progress man gauges the urgency of the tool relative to the order it is required for, and estimates a completion date accordingly. As each tool is completed, a copy of the delivery note which accompanies the piece to its destination should be sent to the Progress Department, so that the list of outstanding tools may be corrected.

Apart from the dislocation and consequent delay of production brought about by the late completion of tools, another aspect in connection with tool-room progress must be considered. It sometimes happens that a special order, for which jigs are required, is wanted out in a hurry. The jigs are not ready to time, and the shop foreman, after waiting as long as possible, perceives that there is no possibility of getting the jigs in time for him to complete the unit by the date demanded. He therefore sends the part to the marking-off table, has it marked off and drilled (or milled), and the completed article leaves the factory in accordance with programme. A few days (or weeks) afterwards the jigs arrive, and are promptly turned into the tool store, perhaps never to be wanted again. Thus, through not exerting pressure early enough, either in the tool-drawing office or in the tool room, all this unnecessary expense has been incurred, apart from the fact that the tool maker might have spent his time on something which would have been of use, the marker-off could have given his attention to another equally important job, and the drilling (or milling) operator could have done two jobs in the time taken to do the one in question.

(*d*) *The Pattern Shop.*—This department is an easier proposition to handle from a progress point of view than the tool room. The parent of the foundry, it is one of the very earliest departments to receive the attention of the progress man, for the castings are the limiting feature in the case of the majority of production orders.

The arrival of the detail drawing bearing the order number, and showing that a new pattern is required, should be sufficient to induce the pattern shop foreman to commence operations, and the subsequent receipt of the specification list will confirm his decision, and also group together the whole of the patterns required in connection with this particular order. The pattern shop and the foundry always work in conjunction, whether under one head or run as separate concerns, consequently there is no necessity to time-fix the pattern shop, as the foundry date will be sufficient to inform the pattern maker as to the urgency of any particular pattern.

The Progress Department will record the pattern numbers of all castings required in connection with the order, with a column in which to record the date on which each pattern is sent to the foundry, irrespective of whether a new pattern is to be made or an existing pattern utilised. The pattern shop foreman should send a delivery note with each pattern sent to the foundry, a duplicate copy of this note being sent to the Progress Department. In the event of a pattern being already in the foundry, in use in connection with another order, the same formula should be observed, the delivery note in this case being endorsed "Pattern already in foundry."

The progress man will urge outstanding patterns the moment he considers the margin of time allowed for the completion of the casting has reached its minimum, and may then exact a definite promise of completion from the pattern shop.

When an alteration is necessary to a pattern already in the foundry, the pattern maker should ask on a return note for the pattern, two copies of this note being sent to the foundry, and the foundry foreman, upon returning the pattern, should forward to the Progress Department one copy of the return note, stating thereon the date upon which the return was effected. The pattern would then be treated as a new part by the Progress Department, and a revised date, if necessary, would be given for the completion of the casting.

(*To be continued.*)

THE ELECTRICAL PROPERTIES OF VULCANISED FIBRE.*

By WILLIAM EVES.

The accompanying curves were plotted from test data obtained at the Massachusetts Institute of Technology. In all, 4,000 tests were made, including red, black and grey fibre. The tests were all made with the same electrodes, and the voltage was increased at the constant rate of 1,000 volts per second. At temperatures higher than room temperature the samples were prepared by heating in an oven for one hour for the thinner specimens and from four to five hours for the thicker. Fig. 1, referring to grey fibre of ⅛-in. thickness, shows an average decrease in breakdown voltage in the 25° to 100° C. temperature range of 77 per cent. Tests on a thickness of 0·03 in. showed an increase of 80 per cent. in breakdown voltage for the same range of temperature. The voltage required to break down a sample of thickness greater than ½ in. was greater than most commercial voltages. A comparison of results on black fibre of 0·067 in. thickness showed an average increase of 12 per cent. in breakdown voltage. Greater thicknesses showed a decrease with increase in temperature.

The results of tests with red fibre of ¼ in. thickness showed the average decrease in breakdown voltage in the range from 25° to 100° C. to be approximately 60 per cent. Thin red fibre showed an average increase in breakdown voltage from 25° to 100° of approximately 20 per cent.

The most plausible theory for the change from an increasing variable with increasing temperature to a decreasing variable with increasing temperature but with an increase in thickness, was that the small amount of moisture and zinc chloride in solution caused the resistivity to decrease with increase in temperature, while the fibre lost a certain amount of its contained moisture when heated, greater thicknesses doing so much less rapidly than

* *Electric Railway Journal*, Vol. 51, No. 5.

lesser thicknesses, but not at all in proportion to the thickness. The results of many tests made with the fibre of five large manufacturers were averaged, and the composite results are shown in fig. 2. This curve gives values for room temperature only.

Breakdown Voltages* of Several Thicknesses of Vulcanised Fibre.

Thickness in inches.	Breakdown value. Volts per 0·001 in.
$\frac{1}{32}$	225 to 425
$\frac{1}{16}$	150 to 300
$\frac{1}{8}$	125 to 275
$\frac{1}{4}$	100 to 225
$\frac{1}{2}$	75 to 150

* Results higher than these have frequently been observed, but these limits will include the majority of cases.

Grey fibre was made from paper of the natural colour with no colouring matter of any kind. Black contained a small amount of lamp black or other colouring matter, and red was coloured with a relatively large amount of various grades of oxide of iron. Any

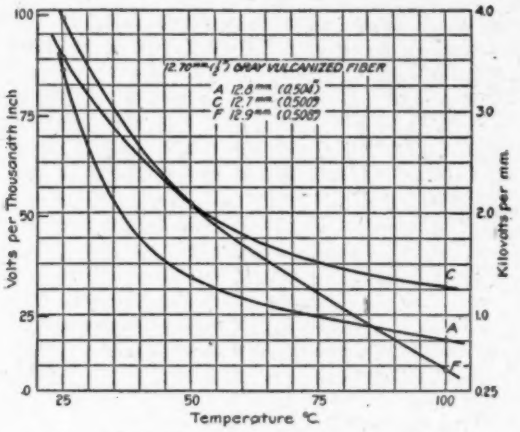


Fig. 1.—Breakdown Voltage of ½-in. Grey Vulcanised Fibre.

loading material placed in the paper from which vulcanised fibre was made, tended to interfere to some extent with the chemical treatment, and the result was a less homogeneous material. Colouring matter acted as a loading material and produced a slightly more "papery" fibre, which usually had a higher breakdown value because of the greater degree of lamination. Fibre was made from three grades of paper, which varied in the degree to which they were gelatinised by the chemical action. The paper from which ⅛ in. to ½ in. fibre was made was treated to the greatest extent with the zinc chloride, and consequently a more homogeneous material with low breakdown voltage resulted. In a large number of cases the loading factor of red fibre was so much more

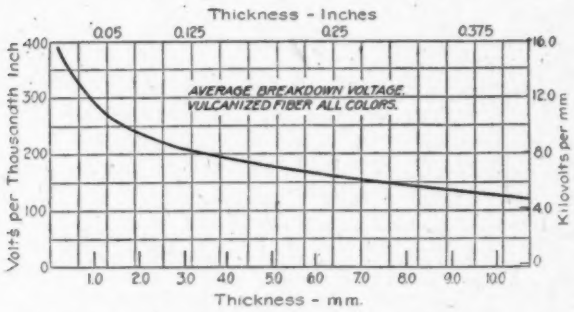


Fig. 2.—Average Breakdown Voltage of Vulcanised Fibre of all Colours.

pronounced than the tendency for the small amount of solution of oxide of iron to lower the breakdown voltage, that the dielectric strength of red fibre would be higher than that of grey fibre. Black fibre was usually between the red and grey grades and nearer the grey in its breakdown voltage.

As vulcanized fibre lost its normal amount of contained moisture, its pliability decreased, and finally it became brittle. This was caused either by application of a sustained temperature of 80° to 100° C., or of higher temperatures up to 200° C. for shorter periods of time. At the latter temperature charring commenced. It had the following strengths in pounds per sq. in.: Tensile, 9000-13,000; compressive, 33,000-43,000; shearing, 9,000-13,000.

Vulcanised fibre was not waterproof. It absorbed water to a certain degree, but was not injured by either hot or cold water, for it returned to its original dimensions and properties when dried. Most dilute acids and alkalis caused no effect other than the effect of water, but concentrated acids caused disintegration. Organic solvents and all oils had absolutely no effect and were not absorbed in the slightest degree.

If the breakdown voltage per thousandth of an inch, the specific gravity, and the cost per pound of vulcanised fibre were compared with the corresponding values for other insulating materials, it would be found that the commercial insulation value of vulcanised fibre was very high. Its ability to be machined with great accuracy and to be bent, punched, and formed to shape should be taken into account. In fact, it could be used in many cases where no other material would answer.

NEW ELECTRIC FURNACES.

(*Concluded from p. 246.*)

An electric furnace for the forging and annealing of steel, using silicon carbide as resistor, was described in a paper read before the Association of Iron and Steel Electrical Engineers, U.S.A., by Mr. Wirt S. Scott; we are indebted to the *Electrical Review*, of Chicago, for the following particulars:—

Mr. Scott's experimental work on resistor-type furnaces for forging has continued through several years. Various combinations of materials, consisting of granular graphite, coke, charcoal, and carbon blocks, have been given exhaustive tests, always with the same general results, all of the above resistor materials being unsuitable for an electric forging furnace.

To secure even moderately successful results, it was found that resistor material must be of the purest carbon or graphite. It is quite difficult to obtain a supply sufficient for operating furnaces. If there is any slag or ash left from the combustion of the resistor, it remains in the bed, so that the relative proportion of such material is gradually increasing with time, causing an increase in the resistance of the furnace.

If the slag or ash is fusible at the temperature of the resistor bed, a clinker will be formed which very rapidly extends through the granular mass, resulting in a rapid increase in resistance and consequent failure to heat.

When the furnace was maintained for a considerable length of time at sufficiently high temperature to turn out heated steel at 1,800 deg. F., it was found that the temperature in the bottom of the resistor bed exceeded the safe limits of refractory materials. With a temperature of 1,800 deg. on the surface of the bed, the temperature at the bottom was approximately 3,600 deg. This great temperature difference is due to the electrical characteristics of carbon, in that as the temperature increases the resistance decreases. An increase in temperature at any part lowers the resistance

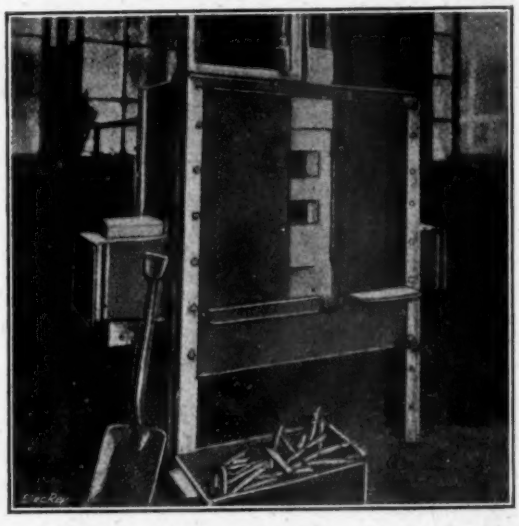


Fig. 2.—A 15-kw. Double-opening Forging Furnace with Pre-heating Chamber.

through that part, which in turn causes more current to flow, and so on, the temperature gradually increasing with the current.

If heat is generated only on the floor of the hearth, the work is heated from the under side only, and instead of receiving heat from the walls and roof, it gives off heat, thereby always having a great difference in the temperature on the two opposite sides. In order to heat the upper surface to a sufficiently high temperature, the lower surface must be overheated.

In 1916 experiments were begun using carbide as a resistance material.

There is no oxidisation of this material in pure oxygen at 1,000 deg. C. From 1,500 to 1,800 deg. C. oxidisation is very much retarded by the fused silica coating. Neutral or reducing gases, such as carbon monoxide, nitrogen, and hydro-

gen, have little or no action. The hardness is between that of the ruby and the diamond. The specific gravity is 3.12 to 3.20. A tensile strength of 1,400 lb. per sq. in. may be attained. At ordinary temperature its conductivity is very low, being several times less than that of carbon. With increase of temperature its conductivity increases very rapidly. The resistivity of the bricks varies with differences in porosity and chemical composition. At 75 deg. F. it is 50 ohms per cm.^{3}; at 1,000 deg. F., 18 ohms; at 1,800 deg. F., 3.7 ohms; at 2,550 deg. F., 0.65 ohm per cm.^{3}

The temperature of decomposition is above 4,000 deg. F., which is approximately 1,500 deg. higher than the hottest temperature required at the surface of the resistor. Due to the construction of furnace employed, the atmosphere in the furnace chamber is non-oxidising, and under these conditions the resistor is non-consuming. It may be moulded in block form, allowing the heating element to be placed in any desirable position around the heating chamber. Due to its high tensile strength, the roof of the heating chamber as well as the hearth may be made out of these resistor blocks. The fact that it has a large negative temperature-resistance coefficient may be utilised in the control of the furnace temperature by controlling the current input to this resistor material.

The first furnace of this type proved conclusively that a temperature of 1,800 deg. F. could be obtained and maintained for an indefinite period so far as the resistor material was concerned.

The second complete furnace had overall dimensions of 46 in. wide, 38 in. deep by 48 in. high, inclusive of an iron stand 12 in. high. The resistor consisted of two blocks 2½ by 4½ in. cross section by 9 in. in length, connected in parallel, one over the heating chamber and one underneath, 2½ in. apart, forming a heating chamber 7 in. wide, 11 in. deep by 2½ in. high. The resistors were surrounded and embedded in a refractory lining made up principally of a crucible clay and a graphite mixture. Surrounding this extremely hot area, silica bricks were used backed up by ordinary fire bricks.

Electrode chimneys or wells were used to connect the resistors with the terminals. The electrodes consisted of granular graphite and an amorphous carbon rod 4 in. square by 20 in. long embedded in each electrode well, and extending upward from near the steel terminal plate at the bottom of each well to the ends of the two resistors. The granular graphite ensures electrical contact between the resistor blocks and the carbon block, and between the carbon block and the terminal plate. A cool terminal is thus obtained.

The heat insulation on the outside of the furnace consisted of 4½ in. of high-grade insulating brick all round, except opposite the electrode wells and around the door. Thin sheet steel held in place by angle iron and tie rods clamped the insulating bricks together.

The starting voltage on this furnace was 75 volts, and the time required to raise the temperature of the heating chamber to a forging temperature of 1,800 deg. F. was two hours. The power required at full load was 10 KW., or approximately 300 amperes at 33 volts. At no load, a consumption of 5 KW. or 200 amperes at 25 volts obtained. This corresponds to an efficiency of 50 per cent.

The longest continuous run extended over a period of 15 days, or 370 hours, the furnace being maintained continuously at a forging temperature of 1,800 deg. After these tests an examination of the resistors was made, but no perceptible effect due to heating could be determined.

The control equipment consisted of a 110-volt transformer with knife switches for obtaining starting voltage, and interlocked magnet switches, push-button operated, for obtaining the required running voltage. A circuit-breaker was used for protecting the furnace against an increase in current above the safe operating value.

The first furnace to be placed in continuous operation under actual shop conditions was made early in 1917. This furnace, a duplicate of the one described, was installed in the tool forging shop of the Westinghouse Electric & Manufacturing Co., and has been in operation for a period of one year, with highly encouraging results. Many runs have been made of continuous operation for periods of 400 to 500 hours, heating high-speed steel to 1,850 deg. F., and drop forgings to 2,200 deg., without any records of resistor failure, or any perceptible deterioration in the resistor due to the high operating temperature. One run of 500 hours was made at a temperature of 2,650 deg. without experiencing any difficulty whatever.

For high-speed steel work, it was found advisable to preheat it before placing it in the heating chamber. A preheating chamber was constructed under the heating chamber, consisting of an opening in the front of the furnace just below the lower resistor, into which the tools could be placed for preheating to eliminate strains that otherwise would be set up in the steel when placed in the furnace.

Another furnace has been built and placed in operation having a heating chamber 18 in. wide, 12 in. deep, and 4½ in. high. The capacity of this furnace is 20 KW., the starting voltage 220, and the running voltage 70. The efficiency is 60 per cent. This furnace is designed to operate on steel drop forgings requiring a temperature of 2,300 deg. F.

As the furnace increases in temperature it is necessary to step down to lower voltages. The control equipment thus far developed is semi-automatic in its action.

The furnace has a very wide application, but experiments thus far have been confined to forging, vitreous enamelling, and the reheating of glassware. A special furnace has been constructed, and is successfully operated for the forming of lamp chimneys.

The furnace described offers an ideal solution for forging and annealing steel, because uniform temperature is obtained in all parts of the heating chambers; the temperature found to produce the most satisfactory results may be obtained and maintained indefinitely; a neutral atmosphere is obtained in the furnace chamber, thereby eliminating the major part of the oxidisation of the steel.

In the *Iron and Coal Trades Review* of April 12th, 1918, particulars were given of the Stobie 15-ton electric furnace.

Until recently large electric furnaces, when used experimentally for melting from cold scrap, revealed in a very marked degree the following defects: (1) The localising of the melting to the region within reach of the arc on each electrode; (2) the rapid destruction of the roof by the high radiant heat of the arcs, which becomes disastrous in large-span roofs; (3) the cutting away of the electrode holes and the extensive surface burning of the electrodes by the flames which gush out of the electrode holes in the roof; (4) the rapid tapering of the electrodes within the furnace, due to

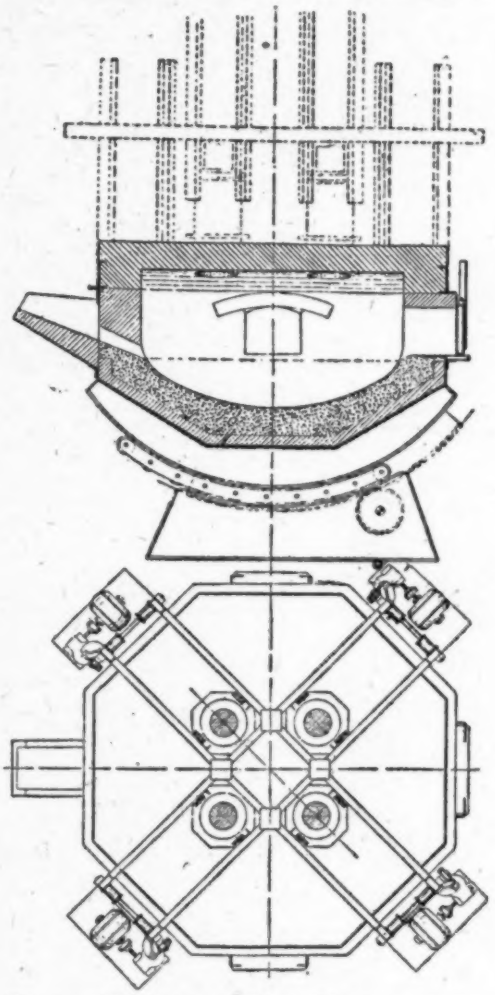


Fig. 3.—15-Ton Stobie Electric Furnace, showing Electrode Economisers.

oxidisation by the air drawn in through the doors as a result of the chimney effect of the last-mentioned defect; (5) the phenomenally quick loss of heat by the furnace after tapping, resulting from the hurricane of cold air which flows through the furnace doors and out of the electrode holes the moment the doors are opened for fettling and charging.

Each of these defects arose from the impossibility of stopping up the gaps around each electrode where the latter passes through the roof. An important improvement has recently been devised by Mr. Victor Stobie whereby an electric furnace can be completely sealed up, notwithstanding the number of gaps in the roof.

The 15-ton furnace seen in operation by our contemporary's representative at the Stobie Steel Works is the largest electric furnace in this country. A section and plan are given in fig. 3, which shows the roller-tilting gear—a unique feature. By this gear, which is driven from a 15-H.P. motor, the furnace is tilted towards the platform for slag removal,

an opening in the platform permitting the discharged slag to fall to the shop floor level into a bogie for removal. The same mechanism tilts the furnace in the reverse direction for tapping.

The furnace is three-phase, as were the majority of the early types of large arc furnaces. (Mr. Stobie, however, is now building mainly two-phase four-electrode furnaces.)

The principle of the furnace is as follows:—Three electrodes above the bath are connected to the three phases of a four-wire star-connected supply, whilst the fourth electrode is connected to the middle or neutral point of the supply system. The electrode arc gaps above the metal are adjusted according to the phase and interlinked pressures. Any reduction in the resistance of the arc gaps under one of the three-phase electrodes will reduce the resistance of the phase circuit by a greater percentage than it will reduce the resistance of the interlinked circuit; therefore, excess current is taken by the fourth or neutral electrode. Obviously, when a three-phase electric furnace is working the phases are never balanced, owing to the constant movement and fluctuation in the resistance of the material which is being melted and the "waviness" of the surface of the bath when molten, so that the neutral electrode will constantly carry current and do its share of the heating or melting of the charge.

As regards electrode consumption, the major portion of it does not take place at the arcing points, but results from the surface burning of the carbon all over those parts of the electrode which are inside the melting chamber, and up to a point about 12 in. above the roof, and it will be well within the mark to say that from 50 per cent. to 70 per cent. of the heavy expenditure on electrodes is wasted through this defect. Amongst many devices employed to remedy this defect, which is of more serious moment in the large furnaces, mention may be made of a method of (1) enveloping the carbons with asbestos paste held in position with wire-netting, (2) coating the electrodes with non-burning paints, and (3) surrounding the electrodes with water-cooled cylinders extending well inside the furnace. With regard to (1), this is very expensive to apply, and quickly perishes within the melting chamber; in (2) the non-burning coatings all expand and fall away from the non-expanding electrode; and in (3) the internal water jackets are most wasteful of heat, are ineffective, and a source of danger within the furnace.

Observation shows that at one or two feet above the roof in most electric furnaces, the electrodes, even when raised high for charging, are seldom at a temperature at which they can burn; therefore that is the only point at which a permanently good seal can be made round the electrodes. It is only necessary to enclose hermetically an electrode from the roof up to that point to prevent its burning away, and the consequent escape of the heated gases from the furnace.

For this purpose Mr. Stobie provides a light metal cylinder a few inches larger in diameter than the electrode, and about 2 ft. in length, which is fixed on to the roof round each electrode. A sealing of fireclay is made where the bottom of the cylinder meets the roof, and the top end of the jacket is covered with a sealing plate which prevents the passage of the flames, the electrode passing through a neatly fitting hole in the centre of the cover plate. In effect this improvement has accomplished far more than one would expect from so simple a device, and it may be worth while to consider the results of its application in detail.

1. As there is no chimney effect no cold air is drawn into the furnace.
2. Practically all surface combustion of electrodes is arrested.
3. A really reducing, carbon depositing (when desirable) atmosphere is constantly present within the melting chamber.
4. The entire original sectional area of the electrodes is available for current carrying, as they do not become pencil-pointed. The electrodes may therefore be of much smaller diameter for a given current supply. In addition to cutting down electrode costs, this permits a reduction in the size of electrode holes in the roof, and thus strengthens the roof.
6. There is no heat loss from escaping flame, and at the same time there is a corresponding increase in speed of work.
7. Heavy carbonaceous vapours in the furnace act as an opaque pall between the heat from the arc and the roof, thus reducing cost of repairs to both roof and lining.
8. Electrode holders and gear keep cool without water-coolers.
9. Cooler working conditions exist for the furnace hands and the melting shop generally.
10. After tapping, the heat is retained in the furnace just as in the open-hearth furnace. This considerably reduces the fluctuations of current on starting, preserves the lining, and speeds up the melting.

It is claimed that a large electric furnace with the Stobie economisers attached can produce best-quality steels at the same price as an equal-sized Siemens furnace, and the product is, of course, well known to be more perfect in finish and composition than the best open-hearth furnace steels.

At the time of our contemporary's visit to Dunston one 15-ton Stobie furnace was making nickel-chrome steel in six hours from tap to tap—in fact, the books show that there is a regular output of 24 heats per week. The actual life of the roof has not really been determined; output at the moment is the vital necessity, and no risks are therefore taken, the roof being replaced every third week.

The energy consumption per ton of saleable ingots (nickel-chrome steel) varies from 600 to 625 units. The actual loss is 2½ per cent. of the total metal charged. In July, 1917, the output was over 1,000 tons, a figure which has since been maintained.

Two new 15-ton furnaces have recently been put into commission, and designs have been made for a 30-ton furnace fitted with the Stobie economisers, and the inventor claims that 60-ton electric furnaces are feasible provided they are fitted with economisers. It is claimed that the Stobie type of economiser can be applied to all existing types of electric furnaces, and will effect economies estimated at between 30s. and 40s. per ton of steel manufactured.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

14,213. "Electric arc lamps." W. ENGELKE & H. H. WRENCH. September 2nd.
14,221. "Electric switchgear." H. W CLOTHIER, R. W. GREGORY AND A. REYROLLE & Co. September 2nd.
14,223. "Alternating-current relays." C. V. DRYSDALE. September 2nd.
14,227. "Sparking plugs for internal-combustion engines." J. K. WHITE. September 2nd.
14,228. "Determining electrical characteristics of high-frequency oscillation circuits." N. P. HINTON. September 2nd.
14,235. "Electric-arc furnaces." J. BIBBY. September 2nd.
14,239. "Electromagnetic speed-controlling device." REMY ELECTRIC CO. September 2nd. (U.S.A., September 1st, 1917.)
14,242. "Safety device for oil tanks of electric transformers, &c." AKT. GES. BROWN, BOVERI ET CIE. September 2nd. (Germany, September 1st, 1917.)
14,264. "Electric welding." W. E. LEONARD. September 2nd.
14,284. "Electric lamp and switch holder." A. P. RUTHERFORD. September 3rd.
14,301. "Electrical warp stop-motion for looms." H. BURTON & A. UTTLEY. September 3rd.
14,315. "Dynamo-electric machine." BRITISH THOMSON-HOUSTON CO. AND A. A. POLLOCK. September 3rd.
14,322. "Welding controllers." IGRANIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co., U.S.A.) September 3rd.
14,328. "Incandescent electric lamps." W. H. HIGGS. September 3rd.
14,350. "Electro-magnetic separator." W. E. POOLE. September 4th.
14,362. "Electric motor control gear." R. H. BARBOUR, E. SCHATTNER AND J. R. WALTON. September 4th.
14,372. "Means for improving conductivity at joints of electrodes." C. W. KAYSER & D. W. MACDONALD. September 4th.
14,397. "Electric relay mechanism." G. A. BETULANDER. September 4th. (Sweden, September 4th, 1917.)
14,401. "Ignition sparking plugs for internal-combustion engines." F. L. RAPSON. September 4th.
14,448. "Electric light and heat fittings." C. J. LANE & G. L. WINGATE. September 5th.
14,451. "Lock-out switches." IGRANIC ÆLECTRIC CO. (Cutler-Hammer Manufacturing Co., U.S.A.) September 5th.
14,458. "Telephone apparatus." M. LATOUR. September 5th. (France, September 5th, 1917.)
14,475. "Sparking plugs for electrical ignition systems." W. A. JONES. September 6th.
14,505. "Magneto-electric generating machines for lighting vehicles, &c." N. C. F. JENSEN & M. J. E. TILNEY. September 6th.
14,510. "Electric arc lamps." W. T. COULSON. September 6th.
14,523. "Adjustable interrupter for ignition dynamos." SPLITDORF ELECTRICAL CO. September 6th. (U.S.A., May 16th.)
14,530. "Electric accumulators." W. G. PEARSON & S. D. WHITE. September 6th.
14,559. "Direct-current dynamo-electric machines." B. J. SHILLITO. September 7th.
14,567. "Signalling apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) September 7th.
14,574. "Electric ignition devices for internal-combustion engines." A. H. MIDGLEY AND C. A. VANDERVELL & Co. September 7th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

10,164. MACHINE SWITCHING TELEPHONE SYSTEMS. Western Electric Co. and L. Polinkowsky. July 13th, 1917. (118,133.)
11,511. ELECTRIC WELDING. S. C. Cary. August 10th, 1917. (118,138.)
11,534. MAGNETIC COMPASSES AND ELECTRIC LAMPS FOR USE THEREWITH. R. S. Mason & A. E. Martin. August 10th, 1917. (118,139.)
11,544. SPARKING CONTROL OF AVIATION ENGINES. W. T. Warren, M. G. Smiles & W. D. Smiles. August 10th, 1917. (118,140.)
11,937. ELECTRIC SWITCHES. Bosch Magneto Co. March 10th, 1916. (100,798.)
12,423. SURFACE ELECTRICAL CONDUITS AND FITTINGS THEREFOR. A. E. White (American Conduit Manufacturing Co.). August 29th, 1917. (118,183.)
14,361. HIGH-TENSION RECTIFYING SWITCH FOR USE WITH MERCURY INTERRUPTERS. A. C. Gunstone & G. Pearce. October 4th, 1917. (118,161.)
14,748. CONTROL OF THE TEMPERATURE IN ELECTRICALLY-HEATED APPARATUS. J. Kiell & A. A. Stow. October 11th, 1917. (118,186.)
15,425. MACHINES FOR MAKING ELECTRODES FOR BATTERIES. S. L. Casella. December 7th, 1916. (111,838.)
16,637. MANUFACTURE OF ELECTRIC CABLES. C. J. Beaver & E. A. Claremont. November 13th, 1917. (Addition to 4,808/17.) (118,199.)
17,546. ELECTRIC FUSES. Multiplex Fuse Corporation. March 31st, 1917. (114,820.)
17,802. ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. H. Lucas & J. H. Chambers. December 1st, 1917. (118,207.)
17,942. ELECTRIC SECONDARY OR STORAGE BATTERIES. F. E. Whitney. September 20th, 1917. (118,208.)
19,090. RECEIVER FOR WIRELESS TELEGRAPHY. J. F. Miller. December 27th, 1917. (118,218.)